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Alpine Europe

A time to live...

Photo © A. Muñoz de Pablos, Paris

Festival in Bavaria

Festivals and folk traditions abound in the Alpine region. Above, near Bad Tölz, a spa town and tourist resort in the Bavarian Alps (Fed. Rep. of Germany), a grandmother and her granddaughter, wearing hats typical of the region, take part in a religious festival in honour of St. Leonard of Noblat. Blessings are bestowed on horses during the festival, which is held each year on 6 November. Popular in the Limousin region of central France, the cult of St. Leonard of Noblat is also practised in Belgium, in Italy, and above all in the south of the Federal Republic of Germany and in Austria.

Editorial

From the Ligurian Sea, between Genoa and Nice, to Vienna, Ljubljana and the Adriatic coast, the Alps stretch in a broad, arc-shaped band through seven European countries: France, Italy, Switzerland, the Federal Republic of Germany, Liechtenstein, Austria and Yugoslavia. Over 1,000 kilometres long and with an area of almost 250,000 km², they are Europe's most important mountain system. Their width varies from some 50 km between the plain of the Po and the Gulf of Genoa in the west, to over 200 km in the Tirol between Austria and Italy in the east. Alpine ridges and peaks, rising in many places to over 4,000 metres, reach their highest point in Mont Blanc (between France and Italy) at 4,807 metres.

The Alps are one of Europe's most important hydrographic systems. Three of the continent's greatest rivers and their major tributaries rise there—the Rhine, the Rhône and the Po, as well as some of the main tributaries of the Danube. Scattered through the Alpine chain are over 4,000 lakes, including Lakes Geneva (France and Switzerland), Constance (Fed. Rep. of Germany, Switzerland and Austria), Neuchâtel (Switzerland), the Chiemsee (Fed. Rep. of Germany), and Lakes Garda, Como, Lugano and Maggiore (Italy).

For thousands of years this vast mountain system has formed a distinct historical and cultural region. Man crossed the Alpine passes in early times, leaving many traces of his presence such as the rock engravings of Valcamonica in Italy and the finds unearthed at Hallstatt in Upper Austria and La Tène in Switzerland, sites of major archaeological importance which gave their names to periods of the Iron Age in western Europe. Today the Alps are a focal point of the communications system linking northern and Mediterranean Europe, crossed by many road and rail passes (the Brenner, the St. Gotthard, the Great and Little St. Bernard, the Mont Cenis) and tunnels such as the Simplon, the St. Gotthard, the Fréjus, the Mont Blanc, the San Bernardino, the Arlberg and the Great St. Bernard.

The Alps also constitute a remarkable example of mountain ecology. Over the centuries man has left a strong imprint on them by painstakingly creating a remarkable landscape and economy, the balance of which is today in many cases threatened by modern developments.

Germanic, Latin and Slavonic elements have largely contributed to the composition of the Alpine population. But demographic and linguistic variety does not preclude the existence of strong common cultural features, such as the affinities which characterize the folk music of different Alpine countries.

This issue of the *Unesco Courier* is an attempt to trace some salient features of the Alpine world which is the geographical heart of Europe, as well as a great historical and cultural centre and a leading tourist attraction.

Editor-in-chief: Edouard Glissant

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40th year

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Cover: climbing in the Aiguilles chain near Chamonix (France), in a range of granite peaks (average height around 3,500 m), which forms part of the highest massif of the Alps and provides a variety of testing climbs for mountaineers. **Back cover:** the Königssee, near Berchtesgaden in the Bavarian Alps (Fed. Rep. of Germany). The impact of tourism and other human activities on the ecosystem and economy of the Berchtesgaden National Park (208 km²) is today being studied as part of Unesco's Man and the Biosphere (MAB) Programme. See article page 9.

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In harmony with nature

The making of the Alpine landscape

by Leo Lienert

WHEN we talk of the Alps, we usually think of the mighty arc of mountains extending across much of Europe from Marseille on the Mediterranean to Vienna in the east. But the word *alp* (or *alpage*) also means "high mountain pasture". How did this double meaning come about? Probably because in former times people were only interested in the useful parts of mountains—passes and the pastureland on their flanks.

It was only much later that the terrible beauty of the Alpine peaks came to be appreciated. Gradually the town and city people began to wish to climb the Alps instead of simply crossing them. To reach the summits they had first to cross the high pastures, and the "back to nature" fashion found an embodiment in the life of the Alpine herdsman. Life in the Alps became a symbol of nature, of man's true vocation.

The well-tended, varied landscape, restful to eye and mind alike, that can be admired in the Alps is not the creation of nature alone. It is the result of stubborn and patient work by mountain farmers and foresters who slowly and painstakingly created the cultivated environment to which we are accustomed. Today, it is our responsibility to preserve this environment, and hand it down intact to future generations. This can be achieved only by a comprehensive environmental protection policy.

Most of today's meadows, heathlands and fields were wrested from the primeval forest by human effort. Except

The perseverance of many generations of mountain farmers has shaped an Alpine landscape whose harmony is the result of a fragile balance between the action of nature and the hand of man. This balance, on which the Alpine economy and environment depend, must be protected against excessive pressures from the consumer society. Right, a village in the Dolomite Alps in northeastern Italy. The Dolomites are Italy's leading Alpine tourist centre, with such well-known summer and winter sports resorts as Cortina d'Ampezzo.

Photo Jacques Languepin © Rapho, Paris.

Source : *Encyclopaedia Britannica*

where there are lakes, peatbogs, steep rocky slopes, scree and eternal snows, forest is everywhere the natural vegetation. All grassland situated beyond the limits of the forest must therefore be tended if it is to be preserved. It is a transitory formation which, without constant human toil, would soon become overgrown and would subsequently revert to native forest. Secondary forest has grown in areas which have been farmed and later abandoned.

As soon as human settlement in the Alps began, the forests began to be cleared and burned. They receded before the grassland established near the earliest villages. A number of sources show that Alpine agriculture developed rapidly in the late Middle Ages. Encouraged by population growth and a period of mild climate, the mountain pastures were intensively exploited. Villages were gradually established up to an altitude of 2,000 metres. Large tracts of forest were felled, and unfortunately felling also took place in areas where trees were indispensable in order to retain the topsoil. As a result, many disasters—avalanches, uncontrolled torrents, rockfalls, landslides—occurred on the edge of forests and on steep slopes. During this period the first mountain roads were made and the first defences against erosion were constructed.

The farmer's task is not only to provide food for the population but to tend and safeguard the agricultural landscape, which is a reflection of human activity and hence of culture. One of the main characteristics of natural areas such as the Alps is their wealth of plant and animal life. The advent of modern farming methods geared to maximum profit (especially single-crop farming) has seriously impoverished the environment as competition with industrial output has forced farmers to increase production and use more fertilizers and chemicals. This is a dangerous situation. Exploitation of the natural heritage of soil, water and air for exclusively economic ends must stop. Instead, these resources should be husbanded as well as possible, taking account of the requirements of plants and animals, as well as human needs.

The dwindling of botanical and animal species is due to the shrinking of their habitat and to changes in farming methods. In all biotopes—regions uniform in environmental conditions and in their populations of animals and plants—there is a strong interdependence between flora and fauna, and any reduction or change in type of grassland has drastic consequences for the animal life associated with it. For example, if areas of dry, sparse, hot grassland are more intensively cultivated, grasshoppers disappear. Similarly, dragonflies, frogs, and certain

Photo M. Strobino © Jacana, Paris

Photo Jacques Brun © Jacana, Paris

Photo © Jacana, Paris

In recent years the rich variety of flowers and animal life in the Alps has been dwindling because their habitat is shrinking and because of the increasing use of fertilizers and pesticides in agriculture. The ecological balance is thus being disturbed. Above, from left to right, three examples of Alpine animal life: two specimens of the rock ptarmigan (Lagopus mutus), camouflaged against the snow by their white plumage; two male Alpine wild goats (Capra ibex) in combat; an Apollo butterfly (Parnassius apollo).

birds which are extremely useful for maintaining the equilibrium of natural living communities, can no longer find food or reproduce when pools, ponds or marshland disappear. Biologists realized some time ago that destruction of the ecological balance is far more of a threat to living species than hunting or gathering. In the Alps, therefore, emphasis must be placed on overall protection of the environment, on the care and maintenance of the biotope in a state which, if not entirely natural, is at least close to the true Alpine nature.

The key to the efficient maintenance of an agricultural landscape close to nature is use of the land according to methods that are geared to the natural conditions in the area in question, and preservation of the necessary habitat of indigenous plants and animals. A thorough knowledge of local conditions is indispensable. Study and mapping of the local geology, soil patterns and plant resources will lead to an understanding of the ecological and biological environment: planning of the Alpine economy must be based on the findings of such research. Land use geared to local conditions will involve separating forest from pasture, and tending wooded areas as carefully as grassland. The forest is protected if livestock are kept out of it, and new stands of young trees can grow in safety.

It has long been known that only healthy and regularly renewed forests afford protection against avalanches. Less well known is the fact that the maintenance—or neglect—of mountain slopes also does much to determine avalanche risk. Short grass, for instance, offers snow a good hold. Long, withered grass lying flattened in a downhill direction forms a surface that favours sliding and thereby increases the risk of avalanches. In other words, every ungrazed slope and every unmown strip of grass is a potential danger.

The factors determining avalanche risk therefore change radically when styles of mountain farming change or disappear. Remote slopes, where in the past skiers could venture without danger, suddenly become death traps. New avalanche corridors soon threaten roads, railways and villages. In such areas, protection must be provided by avalanche barriers, dikes to contain torrents, and by costly reafforestation. But avalanches hurtling down unwooded slopes have undesirable long-term consequences as well as being a source of immediate danger. When snow freezes, clinging to stalks of dry grass which have been left unmown in the autumn, an avalanche will carry down all the grass with it and, even more important, all the topsoil in which it is growing. After such a disaster, only bare rock or loose stones remain. The descending avalanche becomes a rushing mass of earth and mud. In its wake, nothing will grow, and the gaping wound will not heal; the

One way of coping with the problem of avalanche risk is to use artificial means to trigger off avalanches when there is no one around. Below, a young Frenchwoman from the resort of Alpe-d'Huez, Haute-Savoie, one of few women to do this dangerous job, is about to hurl a stick of dynamite. When it explodes on the slope it will start the avalanche.

Photo Jean-Guy Jules © ANA, Paris

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Protecting the Alpine environment

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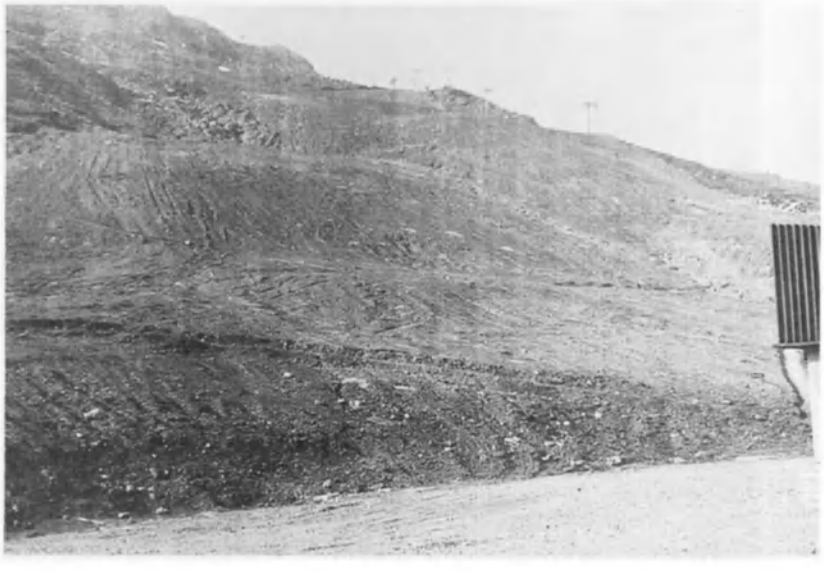

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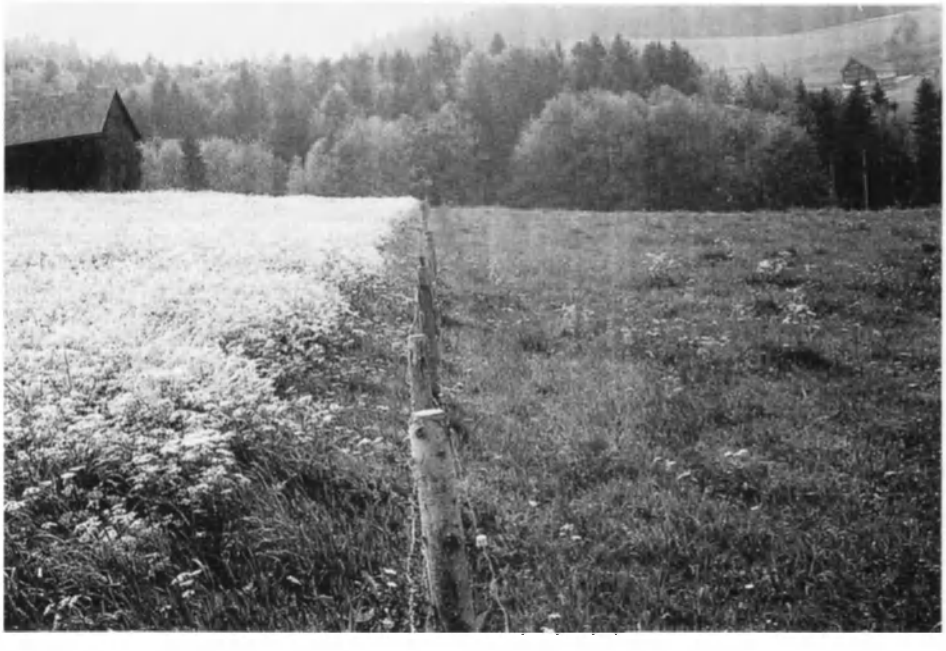
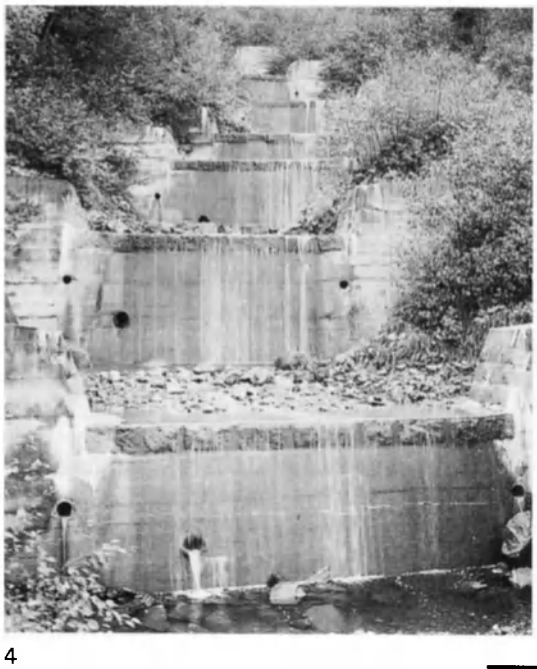
The people of the Alps have always been aware of the need to protect their environment and with it their way of life both against natural hazards and—sometimes a more difficult task—against the consequences of human activity. (1) A flooded meadow at Feldmoos Giswil in the Swiss canton of Obwalden. (2) Anti-avalanche barriers. (3) Ski-slopes in the Swiss canton of Graubünden (Grisons), during the summer. The grass has totally disappeared as a result of erosion caused by skiing. (4) Barriers channel an Alpine torrent at Rotmoosgraben in the Obwalden. (5) Two kinds of Alpine meadow separated by a fence: at left, grass cropped by livestock; at right, grass mown for hay.

5





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Photos © L. Lienert, Paris

scar merely spreads as the years go by. Gradually the whole region becomes defenceless against ever greater torrents of snow, mud and stones—and all because the grass on the slopes was no longer used!

Making and maintaining paths and flights of steps is the responsibility of the local communes and the owners of mountain pastures. When the latter are no longer used, it is difficult to find roadmenders, especially if the forestry authorities cannot take over the task of their upkeep. All hikers should remember that, stone by stone and step by step, the paths leading them through the mountain scenery that they so much admire were made by skilful and hard-working men who knew how to turn the land to the best advantage, digging ditches and building retaining walls where necessary. At any moment, snow, snowmelt and landslides can destroy the results of this painstaking work, unless they are constantly maintained and repaired.

In the mountains, maintenance of a forest that is healthy and close to the natural state is the central task of landscape protection. All forests—even those grown for timber—must be properly cared for and managed. The quality of the forest soil can be maintained only when the trees are regularly replaced: the forest's health depends on this. For example, in recent decades, there has not been enough grazing for cloven-hoofed game animals, with the result that these animals were often forced to feed on shoots and saplings. This jeopardized efforts to renew the forest, and it became necessary to reintroduce predators which had died out, such as the lynx, in order to restore the balance between the forest and its natural inhabitants. If forests were left alone, the new growth of young trees would be inadequate, and there would not be enough protection against avalanches, flash floods and rockfalls.

It is the mountain farmer who, from generation to generation, has created today's Alpine agricultural landscape, and he alone can maintain and safeguard it effectively. At the same time, many mountain farms depend on tourism for their survival. This clearly demonstrates the interdependence of the different economic sectors and the absolute necessity of joint planning. In the context of such planning—and its implementation—priority should be given to safeguarding the landscape by providing economic security for mountain farmers.

Every living mountain landscape has a character of its own, expressed in its language, customs, architecture and crafts. This variety makes a particular region a home for its people. Every valley that loses its inhabitants and every village that dies is an irreplaceable loss. We can no longer afford such losses and such damage. ■

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Photo Jean Gaumy © Magnum, Paris

An engineer performs an acrobatic feat to repair the wheel of a ski-lift at Flaine, a French winter sports resort in Haute-Savoie. Tourism is essential to the Alpine economy today and enables many Alpine farms to survive. At the same time, only the mountain farmer who has created the Alpine landscape can effectively maintain and preserve it. The different sectors of the Alpine economy are today interdependent and planning must take into account and reconcile the interests of all concerned.

by Jörg Schaller

When men and mountains meet

THE aim of Unesco's Man and the Biosphere (MAB) Project 6 in the Alpine region is to reveal the impact of interrelationships between economic activities, land use and ecology and to identify and describe those processes which jeopardize the long-term, sustained protection of the mountain region as a living space, an area of economic activity and a recreation zone.

The research fields and major problem areas were defined by MAB experts in 1973 as human settlements at high altitudes, land use in the mountains, the impact of large-scale technical installations in mountain areas, and the effect of tourism and recreational activities on mountain ecosystems.

Out of a total of 160 MAB 6 projects throughout the world, 85 concern research into the ecosystems of high mountain areas and 10 of these apply to the European Alps (see map). These investigations result from the successful integration of scientific disciplines into regionally co-ordinated research projects largely designed to meet practical requirements.

Thanks to close geographical proximity, many publications on the subject and personal contacts between MAB researchers in the Alpine region, an

Source: MAB

1. Aletsch, Switzerland
2. Berchtesgaden, Fed. Rep. of Germany
3. Briançon, France
4. Aime, Haute Tarentaise, France
5. Davos, Switzerland
6. Grindelwald, Switzerland
7. Obergurgl, Austria
8. Hohe Tauern, Austria
9. Pays d'Enhaut, Switzerland
10. Salzburger Alpen, Austria

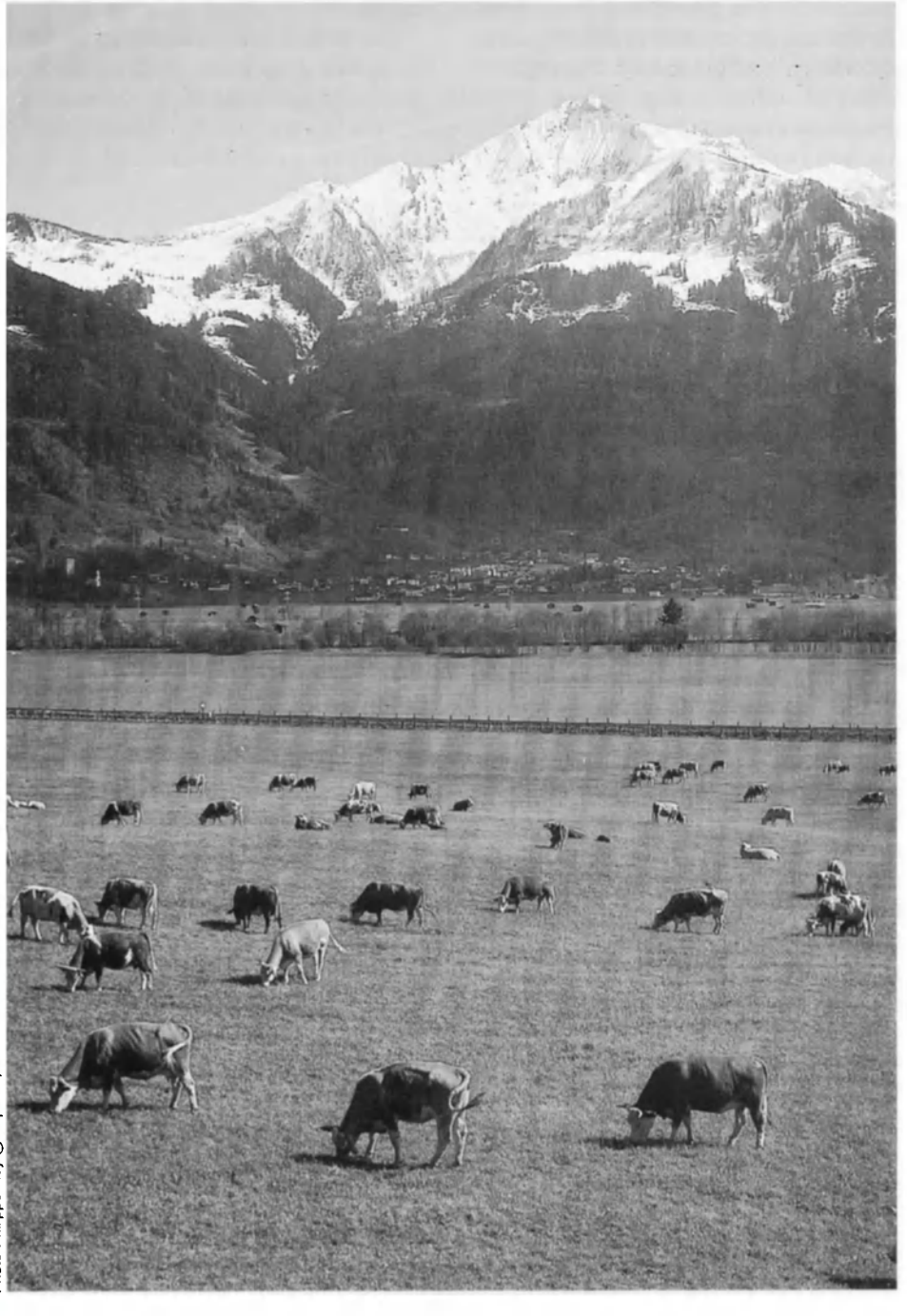

Photo Philippe Roy © Explorer, Paris

Map shows ten sites in the European Alps where research into the effects of human activities on mountain ecosystems has been carried out as part of Unesco's international Man and the Biosphere (MAB) programme. Above, cattle grazing below the Grossglockner, the highest peak (3,797 m) in the Hohe Tauern range of the Eastern Alps. Winter sports, mountaineering and beautiful scenery make the Grossglockner a major tourist attraction.

exchange of experiences has been possible which has led to a substantial improvement in research methodology and the transferability of methods.

Case studies on the impact of different activities on natural resources have been carried out in all MAB projects in the Alpine area. They relate essentially to the land-use impacts of agriculture, forestry, tourism and housing development, which are often in conflict with efforts to protect natural resources. Typical problem areas studied are mountain pastures, the effect of erosion on fertilization and cultivation at high altitudes, the protection and restoration of mountain forests, the disappearance of wild game populations, dying forests and the resultant problems such as landslides, reafforestation, the negative effeet of traffic, damage to vegetation, the massive impact of summer and winter tourism (walking and skiing), as well as the aesthetic impact of changes in methods of cultivation or the introduction of infrastructural equipment for tourism.

In many conservation areas there is the additional question of protecting endangered plant and animal species or symbioses, as well as of monitoring ecosystems in Alpine regions that have hitherto been largely undisturbed. For example, through research at the MAB test sites of Grindelwald (Switzerland), Berchtesgaden (Fed. Rep. of Germany) and Haute Tarentaise (France), the possible impact on the ecosystem and regional economy of holding the Winter Olympics was examined.

The results of MAB research in the European Alps point to three fields of practical application which are exceptionally important for the future development of the sustained management of the natural system on which human life in the Alps is based.

— Practical tools for dealing with complex ecological problems have been developed and can be applied to other mountain regions.

— Thanks to the case studies, bases for decision-making have been created which will enable politicians to introduce the long-term demands of the sustained management of resources into everyday policy.

— Valuable stimuli and ideas for long-term research into ecosystems and the permanent observation of Alpine ecosystems can be drawn from the results of the MAB Research Project because, thanks to its integrated approach, limited research resources can be concentrated on priority areas and on acute problems. ■

JÖRG SCHALLER, *of the Federal Republic of Germany, is an agricultural engineer specializing in landscape ecology and landscape planning. Since 1984 he has been director of a landscape planning bureau and manager of the Environmental Systems Research Institute (ESRI) in Kranzberg, near Munich. He is director of research into the ecosystem of the Berchtesgaden Alpine and National Park, Bavaria, one of the test sites in Unesco's Man and the Biosphere (MAB) Project 6: Impact of Human Activities on Mountain Ecosystems.*

Grindelwald in the Bernese Oberland, near Interlaken, is a leading Swiss mountaineering, summer and winter sports resort. The impact of tourism and recreational activities on natural resources is one of the major questions being studied by MAB research projects in the Alps.

Photo © PM, Bildarchiv, Zollikofen, Switzerland

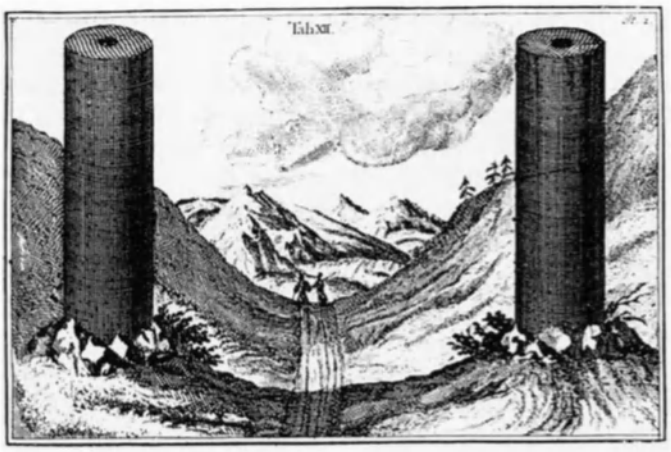

Photo © Central Library, Zürich

The great transalpine routes

Photo Paolo Koch © Rapho, Paris

by Bruno Parisi

The "Julian columns", top, stand at the highest point of the Julier Pass (2,284 m) in the Swiss Alps. Of Celtic or Roman origin, they are shown here in an engraving from a guide to routes across the Alps written by the Swiss naturalist Johann Jakob Scheuchzer (1672-1733). Above, the modern road across the St. Gotthard Pass in Switzerland (2,112 m).

THE Alps carry more traffic than any other mountain system in the world. The total length of roads and railways is 405,000 kilometres. Over this network between 1978 and 1982 passed an annual average of 87 million tonnes of goods, 78 million passengers, and 6.8 million light and heavy motor vehicles. Most of the main routes are the same as those which have been used for the last 3,000 years, since the time when the technological revolutions in the use of bronze and iron took place in the Alpine region.

Archaeological findings show that about four centuries after the foundation of Rome in 752 B.C., there were at least forty settlements in the Alps, each of which had a relatively large, stable population predominantly engaged in extracting and working copper and iron. Judging from investigation of their ancient burial grounds, there were such settlements at Hallstatt (near to what is now Salzburg, in Austria) and La Tène (Lake Neuchâtel, in Switzerland), two major sites which have given their names to Iron Age cultures.

As early as the second century B.C., the Roman historian Polybius knew that there were four passes over the Alps—one through Liguria, two through the kingdom of the Taurini and the Salassi, and another through Resia. The route that Augustus made into a highway doubtless led to the first of these. Near to this highway, in A.D. 13, he erected a monument in Turbia, near Nicala (now Nice) to mark the subjection of forty-five Alpine tribes. This road continued westward to the port of Massilia (Marseille), which the Phoenicians had made a centre of the tin trade. The second pass was probably the Col de Montgenèvre; the third may have been either the Little Saint Bernard or the Great Saint Bernard, and the fourth was probably the Brenner Pass.

The Mont Cenis Pass, by which Hannibal crossed the Alps in 218 B.C. with 20,000 infantry, 6,000 cavalry and 27 elephants—and, after him, his brother Hadsrubal—was used by the Romans in their wars against the Gauls and to protect Marseille. It is the only pass of which we have a detailed description by later classical writers such as Strabo (first century A.D.) and Ammianus Marcellinus (fourth century).

There were no surfaced roads over the Alps before Roman times, only paths by which the mountains could be crossed on foot, by donkey or on horseback. Nothing was done to make these old tracks into roads for wheeled traffic until 12 B.C., when the emperor Augustus built the Via Julia Augusta, a coast road with extensions into several transalpine countries. A few years later the great highway from Verona to Pons Drusi (Bolzano) was begun; it went as far as the Resia and Brenner Passes, and it was known as the Via Claudia Augusta because it was completed by the emperor Claudius.

The Roman legions and settlers were thus able to make their way across all the main Alpine passes by excellent roads, along which large, stable settlements appeared.

In the early Middle Ages, after the fall of the Roman Empire and the collapse of the old pagan civilization, the ethnic subdivisions that we know today were coming into being in the enclosed feudal world of the Alpine region. But along the

old Roman roads, which made contacts between people easier, Christianity was gaining ground as a result of the work of evangelists. Evidence of the spread of Christianity can be seen in the chain of monasteries in the Alps, from the early eighth-century abbey of Disentis (in what is now the Swiss canton of Graubünden), to the monasteries of Pfäfer, San Candido, Scharnitz (near Partenkirchen), and Kremsmünster (founded as the base point for the conversion of the Slavs), and the monasteries on the Great Saint Bernard, the Simplon and Mont Cenis.

In the Middle Ages the Via Claudia Augusta of Antiquity was still the main route across the central Alps. There was no real improvement until the demographic and socio-economic revival early in the second millennium A.D.: in 1237, the Schöllenen Pass from the Devil's Bridge to the Saint Gotthard—the so-called "people's road"—was opened. The opening at that time of good roads capable of carrying wheeled traffic was due mainly to the efforts of the great merchants who wished to trade in the urban fairs. Thus the road over the Simplon, which was not used for a century after 1450, was reopened through the efforts of Kaspar von Stockalper (1609-1691), a typical figure of the pre-capitalist merchant era, who became known as the "king of the Simplon". Then the Fischer family of Berne set up a regular postal service over the Simplon; similar services were set up along other roads—the Splügen, the Saint Bernard and the Saint Gotthard. Goods were still conveyed by long trains of pack animals.

The modern network of roads across the Alps only began to take shape in the first half of the nineteenth century, when many carriage roads were built. As early as 1801-1805, Napoleon gave orders for the construction of a new highway across the Great Saint Bernard; as much as 8.4 metres wide in places, and 63 kilometres long, it had 611 bridges and seven tunnels. The modern highway over the Maloggia Pass dates from 1839.

The situation began to change more rapidly with the coming of steam, which in turn was stimulated by strategic considerations that led to the construction of the first railway line in the Alps, the Semmering line (Austria) in 1854. A few years later the Brenner line (1867) and the Fréjus line between Piedmont and France (1871) were built. After the invention of nitroglycerine and of the pneumatic drill a number of railway tunnels were built (a total of 250 kilometres): the Saint Gotthard (1882), the Arlberg (1884), the Simplon (1906) and the Caravanche and Wocheim tunnels on the Salzburg-Trieste line. Besides these great international tunnels, national railway lines were built, mainly to attract tourists. Notable among them was a line opened in 1898, which ran through a tunnel under the Kleine Scheidegg and rose to a height of 3,457 metres above Interlaken in the Jungfrau massif.

Since then the importance of roads has grown steadily, with the development of motor traffic, the introduction of asphalting, protection against avalanches and the ventilation of tunnels. In this decade, the volume of traffic across the Alps amounts to 20 per cent of the number of passengers and 15 per cent of the goods transported in the EEC countries.

In recent years the Mont Blanc (1965) and Saint Gotthard tunnels, together with the Great Saint Bernard, San Bernardino and Fréjus (1985) tunnels and the Tarvisio motorway (1966) have been the principal factors in the extension of the road network in the Alps.

Modern transport technology has also played an important role in the installation of pipelines, which in 1979 conveyed 43 million tonnes of hydrocarbons from Liguria, the Padua region, Trieste and the Swiss canton of Valais, to Ingolstadt (Bavaria) and Vienna (via Linz), and in the development of high-tension electrical lines. ■

Early 18th century engraving of the Devil's Bridge across the Schöllenen gorges in the upper valley of the Reuss river, which rises in the Aare-Gotthard massif (Switzerland). The gorges were impassable until the Devil's Bridge was constructed in the 13th century, giving access to the St. Gotthard Pass and opening up one of the great transalpine routes.

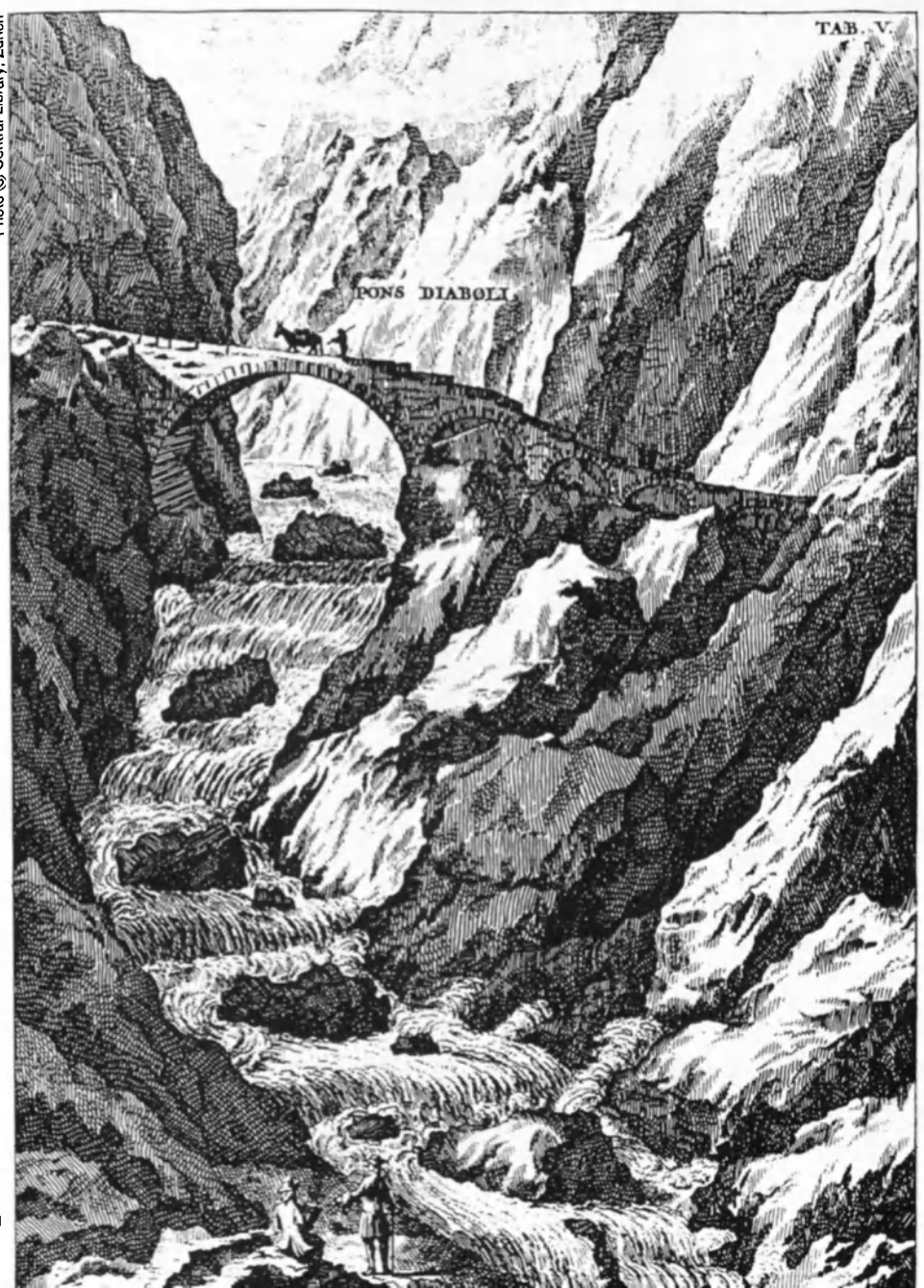

Photo © Central Library, Zürich

Photo by permission of the Birmingham Museums and Art Gallery, UK

BRUNO PARISI, *of Italy, is associate professor at the* Facoltà di Magisterio *(teacher training faculty) of Milan and Brescia, director of the Institute of Geography at the Catholic University of the Sacred Heart, Milan, and president of the Central Scientific Committee of the Italian Alpine Club. Among his published works are "Funicular Railway Transport in the Service of Tourism in the Alps" and "Geographical Bibliography of the Alps".*

The Pass of St. Gotthard ***(c. 1803-4), oil on canvas by the English painter Joseph Mallord William Turner (1775-1851). The work reveals the artist's amazing skill at painting mountain peaks glimpsed through swirling mist and anticipates the atmospheric effects that he was to obtain in later paintings.***

The Walser

Carrying his implements and provisions on his back, a Walser mountain farmer sets out for his Alpine hut in the Graubünden highlands.

by Paul Zinsli

Migrant farmers who settled in high places

THE Walser were peaceful mountain farmers who in the late Middle Ages left their homeland in the Upper Rhône valley, in what is now the Swiss canton of Valais, and founded new, widely scattered settlements in high valleys where they lived in seclusion among groups of earlier settlers who, unlike them, spoke a Romance language. To a certain extent they have managed to preserve their identity and especially their language, a distinctive old German dialect, up to the present day.

For centuries scholars argued about the origin of these "Alpine Germans". Some thought that they were the original inhabitants of the region. Others maintained that they were descended from the guards posted at the Alpine passes by the powerful German Hohenstaufen family. According to other hypotheses, they were the descendants of the Cimbri, the Teutoni, the Saxons, the Frisians, the Swedes, the Huns or even of the Mongolian prince Genghis Khan! They have also been referred to as Burgundian, Goth or Lombard peoples.

The Walser have accumulated long experience of farming at high altitudes in places where the rugged Alpine terrain might have discouraged a less tenacious people. Left, a typical Walser barn perched on a hillside in the Swiss canton of Ticino.

Scientific research long ago showed that the original home of the Walser people was in the Rhône valley. Early fourteenth-century documents refer to them as *illi de Wallis* or "those from the Valais". Feudal charters and documents of enfranchisement granted to the inhabitants of the Rheinwald valley (now in the Swiss canton of Graubünden), in the late thirteenth century, specify the origin of these immigrants. After leaving the Conches valley (now in the Swiss Valais), most of them passed through Val Formazza in Italy on their way to the Raetian area of the Central Alps.

This migration, which took place within a short space of time, was a curious event. With great boldness, this small group of farmers from the Upper Valais scattered in all directions, despite the obstacles of the rugged terrain, and settled over an exceptionally wide area.

In the south, some of them settled in Val Formazza. They built new villages on the upper reaches of nearly all the valleys on the southern flanks of the Alps between the Simplon and Theodul passes. In the far west, in Savoy, there were once two small Walser settlements, significantly known as Les Allamands. In the north they settled in the catchment area of the upper Aare River and, still further afield, their settlements extended into the Bernese lowlands. Their exodus eastwards took them beyond the present frontiers of Switzerland, to the slopes of Liechtenstein until, finally, they spread into the Vorarlberg region.

Initially it is probable that only small groups of families and their modest herds, consisting mainly of goats, left to set up new homesteads far away. The vitality of these emigrants must have been considerable, enabling them to survive the losses that they suffered. It is recorded that each family had many children.

Why was this small group of farmers seized by a sudden compulsion to migrate? Several hypotheses have been put forward: overpopulation of their original homeland, climatic changes or invasions. However, recent research has established that the Walser were forced to move by feudal landlords. In the Bernese Oberland the people of Lötsch were even sold as serfs to the monastery of Interlaken. On the Italian slopes of the Alps, hereditary rulers with estates on both sides of the mountains installed their solid Ger-

manic farmers to defend the passes and the pasturelands.

In return the landowners often had to grant certain freedoms to their subjects. Those who had emigrated to Val Formazza, for example, obtained highly favourable conditions for settling and cultivating the land. The Rheinwalder who emigrated further afield expressly cited these time-honoured "customs" when, like the Walser of Davos (Graubünden), they secured not only full individual freedom of movement based on contracts of hereditary fief, but also the right to have their own independent judicial bodies.

As they settled on still uninhabited or sparsely colonized Alpine lands, the Walser acquired new territory. With the tenacity of those bred to mountain life, they cleared the forests, built new homesteads and worked the higher pastures to obtain winter fodder, living exclusively by cattle raising and dairy farming.

Naturally the Walser colonies changed in the course of time. Entire districts once settled by the Walser again became Romanized, many communities were unable to cope with the hardship of living at rugged heights and disappeared, while others were submerged by the social upheavals of modern life and lost their originality.

The Walser had rarely been allowed to settle anywhere except at high altitudes where the land could not be cultivated permanently. It was in such areas that the bright mountain sun, healthy air and winter snow came to attract mountaineers and winter sports enthusiasts from the lowlands. No wonder, then, that world-famous resorts developed on Walser soil.

The village well at Alagna, on the Italian slopes of the Alps, a region settled by the Walser.

One example is Davos, where ownership of the land was confirmed by charter in 1289 to a Walser, "Wilhelm dem amann [William the Bailiff] and his companions in fair tenure". In today's busy holiday town only some 200 of the 10,000 inhabitants still speak the pure local Walser dialect.

Everywhere, but especially on its most easterly borders, the old, robust Walser speech is dying out, and with it the heritage of a vigorous, dynamic people. ■

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The challenge of living in rugged, isolated surroundings schooled the Walser in resourcefulness and self-reliance. Above, an elderly couple in Graubünden.

Photos © Paul Zinsli, Berne

A mountain village in the eastern Swiss canton of Graubünden. Migrant groups belonging to the Walser, a people whose original home was in the upper Rhône valley, settled in the high, secluded valleys of this region from the 13th to the 15th centuries.

Grenoble, France's high-powered mountain city

by Pierre Frappat

LOCATED in southeastern France between the massifs of Belledonne, Chartreuse and the Vercors, Grenoble is the biggest city in the Alps, demographically speaking. Although it made its name as a dynamic Alpine city by hosting the 1968 Winter Olympics, Grenoble today is primarily an industrial city.

Its most famous son, Stendhal, the author of *Le Rouge et le Noir,* wrote at the beginning of the nineteenth century: "Everything that is low and flat in the bourgeois spirit reminds me of Grenoble; everything that reminds me of Grenoble fills me with horror; no, horror is too noble a word: with nausea." In Stendhal's time Grenoble had only 20,000 inhabitants; today, counting the outer suburbs, it is a conurbation with a population of between 400,000 and 525,000; and everything, or almost everything, has changed.

The spectacular expansion of Grenoble is the result of two waves of industrialization. The first was linked to hydroelectric power, and was triggered off in 1869 when the engineer Aristide Bergès (1833-1904) harnessed the energy potential of a high waterfall at Lancey near Grenoble. Hydroelectric power was to stimulate the development of a wide range of industrial activities, including electro-metallurgy, boilermaking and the manufacture of electrical equipment, some of which still go on today. The second wave of industrialization took place in the 1950s and 1960s, and is associated with the French scientist Louis Néel (Nobel Prize for Physics, 1970), who founded the Grenoble Centre for Nuclear Studies. While a highly diversified pattern of industry continued to exist, there was an increasing emphasis on research which encouraged the rapid growth of the electronics industry.

In the space of twenty years, the population of Grenoble almost tripled, rising from 147,000 in 1954 to 388,000 in 1975. At this period Grenoble led all other French cities in demographic growth.

Immigration was the essential factor in this population growth. At first the new migrants came from the nearby mountains of the historic French province of Dauphiné, which underwent rapid depopulation in the second half of the nineteenth century. The Pre-Alps of Chartreuse and the Vercors, but above all, the Matheysine plateau and the Oisans massif south of Grenoble, and even the more distant massifs of the Briançonnais and the Maurienne, sent what were in many cases the most enterprising members of their population to try their luck in the flourishing city. Whereas the people of Savoy, another nearby province, left the region (winning a name for themselves as "little chimney-sweeps" in Paris) the mountain people of the Dauphiné found their openings nearer home.

However, the mountains only provided a quarter of the new population of Grenoble. Most of the immigrants came from elsewhere in France or abroad, as part of an influx that illustrated the growing attraction of Grenoble. The newcomers filled the ranks of the two social groups that are characteristic of Grenoble: the industrial workers who constituted as much as 42 per cent of the labour force in 1968 (31 per cent today), and the higher executives and supervisory staff who today make up some 32 per cent of the city's working population.

Immigrants of non-French origin were an important source of industrial labour. Between the wars the non-French element was already substantial (18 per cent of the population). Today foreigners may constitute no more than 13 or 14 per cent of the total, but many of them are well integrated, especially the Italians, who mostly originate from southern Italy. Several thousand *Grenoblois* originate from the little town of Corato in Apulia. The Italians of Grenoble are strongly attached to their identity; they have their own Catholic parish, a radio station broadcasting in Italian, and even a Juventus supporters' club which crosses the Alps to attend football matches in Turin. But today the most numerous foreigners are Algerians, Tunisians and Moroccans. Attracted

Photo © A. Muñoz de Pablos, Paris

More than half of the working population of Grenoble are employed in industry. Left, an employee of a leading French electrical company whose activities are centred on Grenoble and the surrounding region.

Photo © A. Muñoz de Pablos, Paris

Above, view of Grenoble and its river, the Isère, against a backcloth of snowy mountains.

to Grenoble at a time when big public works projects were in full swing, they are tending to settle in the city, many of them with big families. They now account for about 5 per cent of the population.

The very high percentage of executives and supervisory staff, which is the salient feature of Grenoble society, is due to the large number of technicians, engineers, researchers and teachers employed in high-technology industrial activities, research centres and universities. Grenoble was one of the first French cities to refute the pessimistic thesis advanced by the economist Jean-François Gravier in 1947 in his book *Paris et le Désert Français;* it became, especially in the 1960s, a centre of social, cultural and political initiatives.

In the last ten years new trends have appeared as a result of which Grenoble has lost its distinctive character in demography and in many other fields. The balance of migration is now negative and the population has stabilized. It is true that more people are leaving the city than before—Grenoble has always been a place where people come and go—but above all far fewer are moving in. The mountains no longer send emigrants, the influx from other countries has slowed to a trickle.

On the other hand, continuing executive and other immigration from within France shows that Grenoble has not lost its power to attract, in spite of an economic crisis from whose effects it is to some extent, but not entirely, spared. Non-French companies, international laboratories and universities have also attracted highly qualified people from outside France who have brought Grenoble a degree of international standing and added to the diversity of a city whose site at the foot of magnificent mountains has always been a crossroads and meeting place of peoples. ■

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Photo © Joco Znidarsič

The Alpine culture of Slovenia

by Matjaž Kmecl

Above, Yugoslavia's highest peak, Mount Triglav (2,864 m) dominates a popular mountaineering and winter sports region of the Julian Alps in Slovenia. The sacred mountain of the Slovenes, Mt. Triglav ("the three heads") is also a pilgrimage centre. In the words of the Slovene writer Julius Kugy, "Triglav is not a mountain but a kingdom."

THE Slovenes are a Slavic people who settled long ago in the south-eastern part of the Alps, in a region where the jagged limestone peaks of the Julian and Savinian Alps slope down towards the Dinarides, and to some extent in the plain of Pannonia. Nowadays, the vast majority of the Slovenes live in Slovenia, the most northerly of the Yugoslav republics, although another substantial group has its cultural and historical centre at Klagenfurt (Celovec) in southern Austria. There is also a group in an area of north-eastern Italy stretching from Trieste to the Carnic Alps, and a small Slovene community in Hungary. There are some two million Slovenes in these areas; if the members of the far-flung Slovene diaspora are counted, they number between two and a half and three million.

This region, opening onto the Adriatic in the south, forms an east-west corridor through which many peoples have passed in the course of history. Those who crossed it in a southeasterly direction include the Romans, the Crusaders, and the armies of Napoleon and Hitler; those who struck westwards include the Russian General Suvorov and the armies of Austria. In the sixteenth and seventeenth centuries, the region lay on the route of Turkish incursions into central Europe from the south.

The ancient "amber road" and many medieval trade routes passed through Slovene territory, which was also a conduit through which many ideas of the Italian Renaissance spread eastwards. The Slovenes played an important role in the foundation of the university of Vienna, and after the Reformation were instrumental in taking Protestant ideas and writings into the Balkans. Around 1560, Ljubljana, the Slovene capital, already had its own printing press, and the first Slovene translation of the Bible appeared in 1584.

In short, Alpine Slovenia on the Adriatic was a staging-post between the Roman and Germanic worlds of western Europe and the Slavic east, between Venice and Vienna, Italy and St. Petersburg.

Under these influences, an original Slovene culture took shape over more than a thousand years. Among its many creative figures were Herman Sclavus of Carinthia, a monk, astronomer and theologian who translated the Qur'an into Latin in the twelfth century and dreamt of bringing about a synthesis of Islam, Christianity and the paganism of Antiquity; the great sixteenth-century polyphonist Jakob Handl (also known as Jakob Carniolus Gallus, 1550-1591); Anton Janša (1743-1773), one of the founders of modern European apiculture; the mathematician Jurij Vega (1754-1802), who revised the logarithmic tables; Marko Anton Plenčič (1705-1786), who discovered the principle of microbial contamination; Friderik Jernej Baraga (1797-1868), linguist, missionary

CONTINUED ON PAGE 23

Colour page opposite

Above,* Ansicht von Arco *(1495, "The Arco Valley"), watercolour and ink by the German Renaissance artist Albrecht Dürer (1471-1528), who visited Italy for the first time in 1494. He remained until the following spring and painted a number of watercolours of the Alps of the southern Tirol, which rank among his most beautiful works.

Photo © Réunion des Musées Nationaux, Louvre, Paris

Below,* Paysage à Maloja (Piz Margna) *(1924, "Maloja Landscape [Margna Peak]"), oil on canvas by the Swiss sculptor and painter Alberto Giacometti (1901-1966). The Maloja Pass in the Swiss Alps, at Borgonovo, where Giacometti was born, is near the village of Stampa (canton of Graubünden). The artist, who settled in Paris in 1922, often returned to his birthplace in later life.

Photo Pierre Gianadda Foundation, Martigny © ADAGP, 1987, Paris. Private Collection, Switzerland

Covered racks for drying hay (right) are a familiar feature of the landscape in the Slovene Alps where the rainy climate often prevents hay from drying in the fields after being mown. The racks are made from a piece of fencing topped with a roof. In another variant, not shown here, the roof rests on two pieces of fencing which enclose a sheltered space where the farmers store their tools. ▶

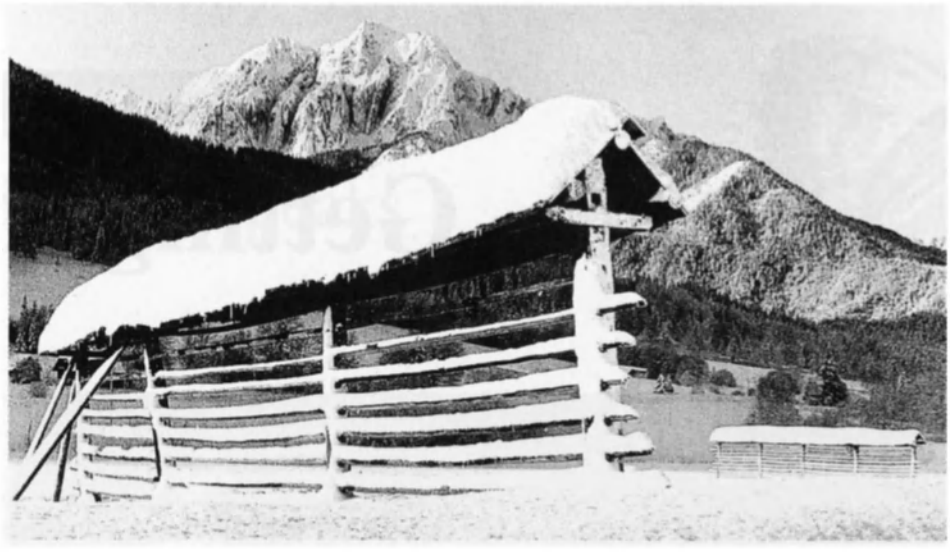
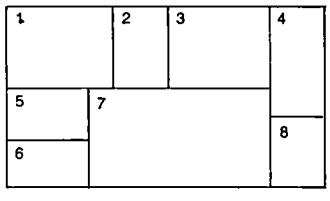


Photo © Joco Znidarsič

Colour pages



Centre pages: (1) Cross-country skiing race at Autrans (France). (2) Vineyards in Liechtenstein, a tiny European principality (160 km²) in the rugged foothills of the Central Alps, with a population of 27,200 (1984). The mild climate, affected by the warm southerly Foehn wind, permits cultivation of grapes, unusual in such a mountainous area. (3) Haymaking in the traditional style in Valle di Gardena, northern Italy. (4) View of Hallstatt, near Salzburg. This little Austrian town, whose salt mines have been worked continually since 2500 B.C., gave its name to the first main period of the European Iron Age. In 1846 a vast ancient burial ground was discovered at Hallstatt, excavations over the next half century yielding a mass of finds of major archaeological importance, including bronze and iron objects remarkably well preserved by the salt. (5) Grenoble (France) is the major Alpine city. Its numerous industries include the manufacture of plastics, rubber, cement and paper. A centre for nuclear research and electronics, Grenoble hosted the Winter Olympic Games in 1968. (6) The Nösslach Bridge on the highway across the Brenner Pass, one of the lowest (1,371 m) and most important passes through the main chain of the Alps on the Austrian-Italian border. (7) The Mont Blanc massif, crowned by the highest peak (4,807 m) in western Europe, lies along the French/Italian border. It owes its name ("White Mountain") to the 100 km² of glaciers which cover its slopes. (8) Ranks of ripening Gruyère cheeses. A hard cow's-milk cheese, Gruyère takes its name from the region of La Gruyère in southern Switzerland. The wheel-shaped cheeses are aged for at least 3 to 6 months, although some may be allowed to ripen for a year or more.

Photos: 1. J. G. Jules © ANA, Paris. 2. S. Weiss © Rapho, Paris. 3. H. Gritscher © Rapho, Paris. 4. H. Gritscher © Rapho, Paris. 5. O. Meot © Explorer, Paris. 6. H. Gritscher © Rapho, Paris. 7. H. le Campion © ANA, Paris. 8. E. Mandelmann © Rapho, Paris

Left: Detail from* Hunters in the Snow *by the great Flemish painter Pieter Bruegel the Elder (c. 1525-1569). Bruegel travelled to Italy in the 1550s, and his appreciation of the sublimity of Alpine scenery acquired on the journey was of fundamental importance for his art. In this famous depiction of a winter scene, the artist mingled elements of the Alpine landscape with that of the Low Countries.

Photo © Bridgeman Art Library, London/Artephot, Paris. Kunsthistorisches Museum, Vienna

CONTINUED FROM PAGE 18

and bishop, who was one of the first authors of grammars and dictionaries of the amerindian languages of North America; and many more, scattered around the world.

It was not until 1918 that the Slovenes were enabled to have their own university, but for centuries before that Slovene scholars and students had made a brilliant contribution to European university life, and even today there are many Slovene intellectuals and artists in universities and scientific institutions all over the world. The nineteenth-century French writer Charles Nodier, an admirer of the polyglot Slovene culture, pointed out how as a result of their cultural history all Slovenes mastered two or three living languages in addition to their own.

Slovenia is a densely wooded region: half its area, or more than one million hectares, is covered with forest. Its wealth of animal life includes bears, wolves, ibex, marmots and chamois, and its plant life is equally abundant (some seventy endemic species). There are many natural caves in the limestone Karst region.

Characteristic features of the landscape are small Baroque and pre-Baroque churches built on the uplands, covered racks with harp-shaped roofs to shelter the hay from the rain which falls when the south wind meets the barrier of the Alps, and castles in varying states of preservation.

Traditional forms of art and craftsmanship still survive. They include lacework from the town of Idrija, naive paintings which have been used to decorate beehives for two centuries, and regional costumes. Male and female choirs such as the Slovene Octet sing serious pieces of music *a cappella,* and instrumentalists play versions of the Alpine tunes known in central Europe as the music of Upper Carniola (Carniola is the ancient name for Slovenia), which have been modernized by groups such as the Avsenik Quintet.

Among its achievements in the fine arts Slovenia can point to the school of architecture founded by the Slovene architect Jože Plečnik (1872-1957); the Impressionists of central Europe, notably the painter Anton Ažbe (1862-1905), who founded a school of painting in Munich in 1891 at which almost all the leading Slav Impressionists studied, as well as Wassily Kandinsky and Nadežda Petrovič (1873-1915); and the Ljubljana school of graphic art. The major figures of Slovene literature include France Prešeren (1800-1849), who had affinities with Byron and Pushkin, and is considered to be the greatest Slovene poet; the prose writer Ivan Cankar (1876-1918), creator of the psychological short novel and of social drama, and the short story writer Ciril Kosmač (1910-1980).

An episode from recent history may help to explain how such a small people has managed to survive without losing its identity and its language. The Slovenes gave proof of their tenacity during the Second World War when they mobilized an army of partisans in their mountain fastnesses and maintained a backbone of national institutions. Then in 1945 the Republic of Slovenia was created within the Socialist Federal Republic of Yugoslavia. As the emblem of their country the Slovenes chose their highest mountain, Mount Triglav (almost 2,900 metres high), "the three heads" which has nourished a host of their legends and beliefs since they became an Alpine people almost 1,500 years ago.

One of the last massifs in the eastern Alps, Mount Triglav is the sacred mountain of the Slovenes; one of its heads looks to heaven, another to earth and the third to the underworld. ■

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Getting to the top

Photo Toni Schneiders © Rapho, Paris

Above, the Vršič Pass in the People's Republic of Slovenia (Yugoslavia) crosses the Julian Alps not far from Yugoslavia's frontier with Italy and Austria. The mountains towering above the pass, some 2,400 metres high, are rocky bastions of jagged dolomitic limestone. For centuries such magnificent Alpine scenery filled travellers with fear and even revulsion.

ANYONE who studies the history of the opening up of the Alps might by forgiven for thinking that until the eighteenth century these mountains were a deserted wilderness. Writers on the subject are fond of quoting from early travellers who describe the mountains as "dreadful", "repellent", even "hideous" stretches of bare rock and ice, reactions which today seem astonishing. Such was the accepted view from Roman times until the eighteenth century. The great Italian poet and humanist Petrarch, who in 1336 wrote an enthusiastic description of a journey he had made to Mont Ventoux in Provence, was for centuries a notable exception to this general rule. Even the Zürich municipal doctor Johann Jakob Scheuchzer (1672-1733), otherwise an enlightened scientist and scholar who is regarded as one of the founders of modern paleontology, seriously maintained that the mountains harboured dragons!

This was how the mountains appeared to the occasional travellers from outside—scholars, merchants, soldiers—who came from the lowland cities and towns. However, a history of the Alps written "from the inside" would tell a different story. Many big Alpine valleys were already inhabited in pre-Roman times, and it is clear that this mountain population had a different, much more natural, relationship with the mountains where they lived. By the early Middle Ages, many valley farmers owned "alps", pastures high up on the sides of the val-

Photo © Central Library, Zurich

In this terrifying depiction of an avalanche from a 16th-century chronicle, a massive ball of debris and flailing branches crushes everything in its path.

The conquest of the great peaks

by Peter Meyer

leys where they grazed their cattle during the summer. From the twelfth to the fifteenth century still higher mountain regions—up to about 1,600 metres—were permanently settled and farmed, in many cases by the Walser, an ethnic group which migrated from the Swiss Valais and established farming communities in wide areas of the central Alpine region (see article page 14). It is also known that at a very early stage a number of Alpine passes were regularly used for trading—and also occasionally for military—purposes. Finally, the Alps were mined for salt, iron ore, and silver, an activity which brought wealth to some and provided a means of subsistence for many more.

This mountain world cannot, therefore, have been as terrible as the travellers' tales cited above would have us believe. But even if there are no dragons, life in the mountains is hard even today, full of privations and fraught with danger. It is also true that until very recently the snow-covered peaks, which are for us the most important and fascinating feature of the mountain landscape, were of no interest to anybody. Until the eighteenth century, they were shown on maps in a very summary fashion and many were unnamed. Only villages, passes and Alpine pastures were indicated. Even where the description "mountain" or its Latin equivalent *mons* appears, it usually signifies not a mountain but a pass or a pasture. Perhaps one or two peaks had been climbed by local people, but such ascents had not been reported and so the world took no notice.

The eighteenth century brought a big change, marked at the outset by a new approach to nature. People became not only more sensitive to the attractions of nature, but also, under the influence of the writings of authors such as Albrecht von Haller (1708-1777) and Jean-Jacques Rousseau (1712-1778), showed a fresh interest in the real or imaginary charms of country life. Stimulated by this romantic longing, the European élite then began to travel to the Alps, thus laying the foundations for Alpine tourism, which expanded rapidly in the nineteenth century.

Once the attractiveness of mountains and their inhabitants was recognized, sporting feats soon began to be accomplished, the first of which was doubtless the ascent of Mont Blanc (4,807 metres) in 1786 by a doctor, Michel Paccard, and a hunter and mountain guide from Chamonix, Jacques Balmat. Thus the conquest of the highest Alpine peak took place, not at the end but right at the beginning of a long series of mountaineering exploits. (The ascent was repeated in the following year by a leading Geneva naturalist, Horace-Benedict de Saussure [1740-1799] who inaugurated the era of scientific research in the Alps with a series of interesting experiments and measurements, including the barometric determination of the height of the peak.)

After the conquest of Mont Blanc, mountaineers turned to other of the highest and most challenging Alpine peaks.

Photo © All Rights Reserved

This humorous depiction of "An Alp-climber" kitted out for a mountaineering expedition appeared as an illustration in Mark Twain's travel book* A Tramp Abroad *(1880). The Alpine tourist is carrying an alpenstock, a long iron-tipped stick once widely used by hikers and mountaineers.

The first to be conquered—almost a quarter of a century after Mont Blanc—were the two highest Austrian peaks: the 3,797-metre-high Grossglockner (1800) and, four years later, the Ortler (3,905 metres, now in Italy). The latter would probably have been climbed first were it not for the fact that people then believed the Grossglockner to be the higher of the two. The ascent of the Grossglockner was a full-scale expedition in which sixty-two persons took part. The Ortler ascent was much more like modern Alpine mountaineering in the sense that the chamois hunter Joseph Pichler who made the ascent was accompanied by only two fellow climbers.

These achievements were soon followed by other feats, outstanding among which were the first ascent of the Jungfrau (4,158 metres) in the Bernese

Drawing of the "Lindwurm", an evil dragon which, according to a legend from the tiny Alpine country of Liechtenstein, once terrorized the people of Mäls, a little town near the Rhine. After vainly trying to get rid of the Lindwurm, the townsfolk begged the Virgin Mary to help them. Their prayers were answered and the dragon disappeared from the face of the earth. (Even today, certain crevices in the rocky cliffs overlooking Mäls are known as "dragon holes.") Located between Switzerland and Austria, Liechtenstein is an independent principality (160 km²) with a German-speaking Catholic population. The capital is Vaduz (5,000 inhabitants).

Photo from *Sagen aus Liechtenstein* ("Tales from Liechtenstein") by Otto Seger, Jahrbuch des Historischen Vereins für das Fürstentum Liechtenstein, 1966

Photo Royal Library, Windsor Castle © HM The Queen, 1986

▲ ***Above,* Storm Breaking over a Village in the Foothills of the Alps, *a drawing by Leonardo da Vinci (1452-1519). With Pieter Bruegel the Elder and Albrecht Dürer (see colour pages), who both crossed the Alps on their way to Italy, Leonardo was among the first European painters to depict the grandeur of high mountain scenery.***

Photo © Bibliothèque Nationale, Paris

Drawing of the* Via Mala *by Johann Wolfgang von Goethe (1749-1832), dated 1 June 1788. This Alpine route leading to the Splügen Pass was extensively used in medieval times, although it was known as "the bad road" because of the gorges through which it passed. It has come back into use since the opening of the San Bernardino road tunnel.

◀ ***The Geneva-born writer and philosopher Jean-Jacques Rousseau (1712-1778) was one of the first Europeans to celebrate the beauty of mountains. Engraving, left, by the French artist Jean-Michel Moreau the Younger, illustrates an episode from* Emile *(1762), Rousseau's treatise on education. It shows Rousseau and the Savoyard vicar, a composite portrait of two priests whom Rousseau had known, contemplating the river Po and the Alpine range beyond.***

Alps in 1811 by two industrialists and naturalists from Aarau, Johann Rudolf and Hieronymus Meyer, and the first ascent of the Zugspitze (2,962 metres), Germany's highest peak, in 1820, as part of a cartographical mission by Lieutenant Karl Naus and two companions. These expeditions were followed in 1850 by the ascent of the Piz Bernina (4,049 metres), the only peak in the Eastern Alps higher than 4,000 metres and in 1855 by the first ascent of Switzerland's highest peak, the 4,634-metre Dufourspitze in the Monte Rosa massif. In 1865 the first ascent of the Matterhorn (4,478 metres), reputedly the most beautiful mountain in the Alps, hit the headlines because a tragic accident occurred during the descent, in which four members of the expedition, led by the Englishman Edward Whymper, perished. This was the first catastrophe of the early days of Alpine climbing but—typical of this sport—it acted not as a deterrent but as a spur to further feats by climbers who, after the highest peaks had been conquered, began to undertake ever more difficult climbs.

Photo Georg Gerster © Rapho, Paris

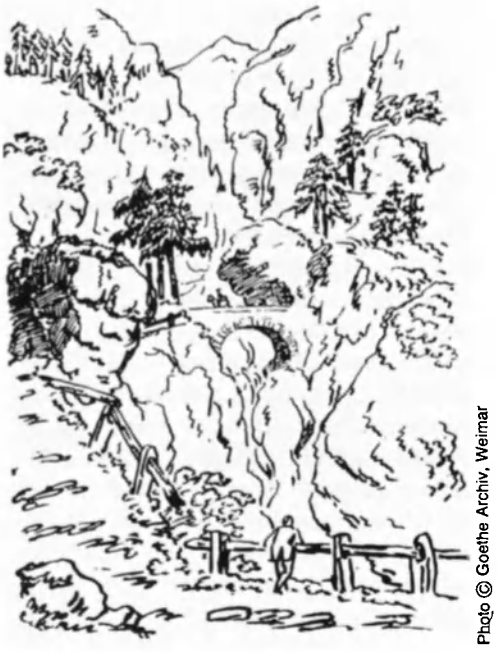
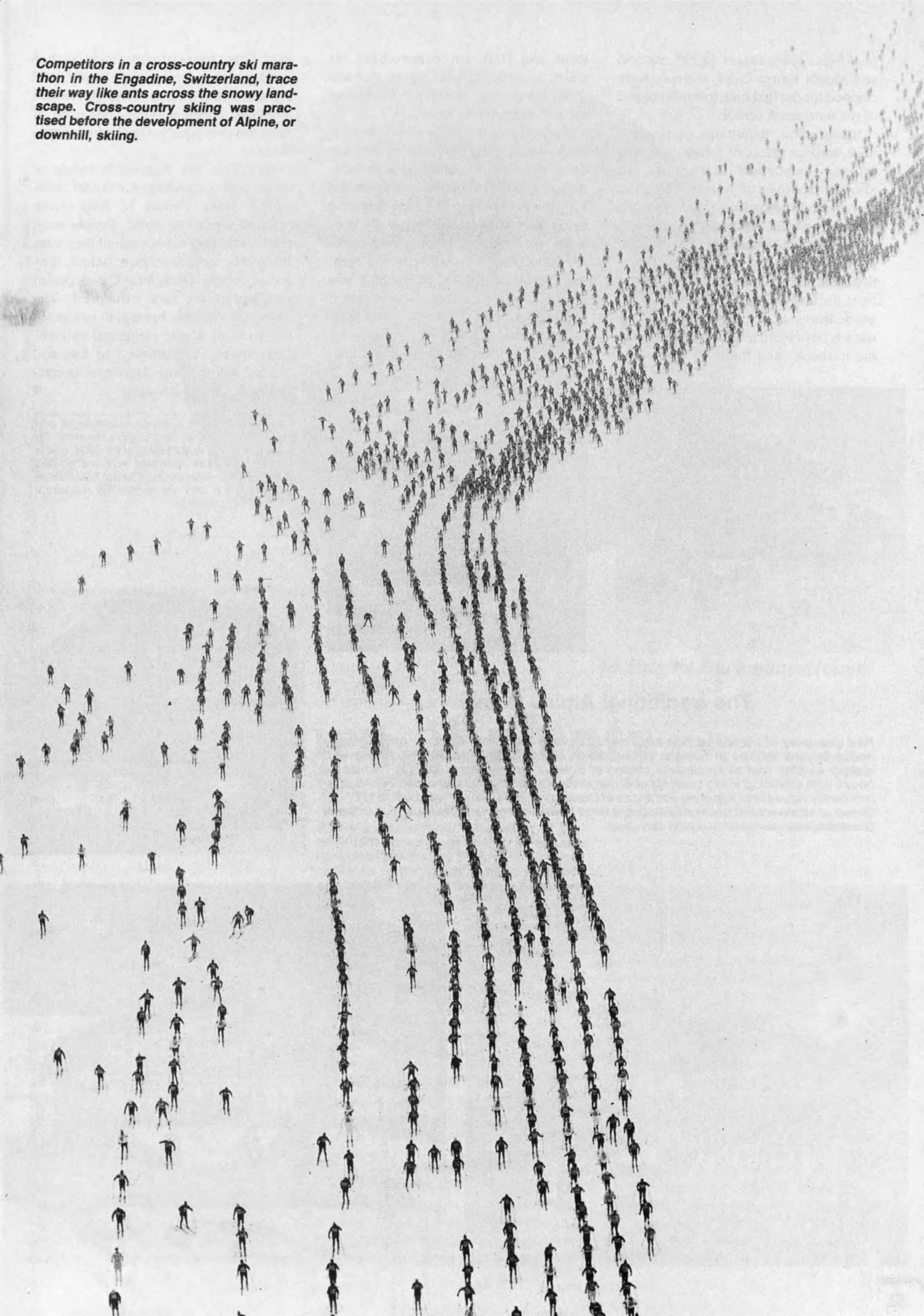


Photo © Goethe Archiv, Weimar

The conquest of peaks gave way to that of certain rock faces—in 1872 the 2,000-metre east face of Monte Rosa, and in 1881 the almost equally high east face of the Watzmann. The first winter ascent of Mont Blanc was made in 1876 by an Englishwoman, Mary Isabella Straton, accompanied by guides from Chamonix.

In the nineteenth century mountaineering began to spread from Europe to other continents. The volcanic mountains of Mexico were conquered at a very early date—Popocatépetl (5,452 metres) in 1827, the Pico de Orizaba (5,700 metres) in 1851, Iztaccíhuatl (5,286 metres) in 1889. The highest mountains



Competitors in a cross-country ski marathon in the Engadine, Switzerland, trace their way like ants across the snowy landscape. Cross-country skiing was practised before the development of Alpine, or downhill, skiing.

in Africa, Kilimanjaro (5,895 metres) and Mount Kenya (5,200 metres), were climbed for the first time towards the end of the nineteenth century.

In our time, mountains everywhere have become places of refuge, not only for many animal and plant species, but also for millions of human beings in search of relaxation from the stress of the modern world. Winter, previously endured as a season of cold, darkness and privation, has suddenly become attractive. And in few places does winter, apart from its dangers, display so many pleasant features as in the mountains. The snow is better and more plentiful than in the lowlands, and there are more sunshine and fresh air, commodities for which there was already a great demand in industrialized, urbanized Europe of the mid-nineteenth century.

Again it was the British who gave the lead. When they first started to slide down the Swiss mountainsides on long, narrow laths of wood, they drew smiles from the local people. But soon they were being eagerly imitated. Naturally they could not have foreseen the extraordinary popularity which skiing would eventually achieve. By the 1930s there was already a boom in winter sports, but it was cut short by the Second World War. As soon as the War was over, winter tourism began to develop more rapidly than ever. Other forms of winter sport, such as curling, tobogganing, ice-skating, and cross-country skiing, soon developed alongside downhill skiing, but none of them has ever equalled the latter in popularity.

Nowadays the Alps—this sweep of mountains extending for 1,200 kilometres from Vienna to Nice—have reached saturation point. People must realize that they cannot get all they want from this unique region unless they accept certain disciplines. Development possibilities are now exhausted. The space still available belongs to nature, to the world of Alpine plants and animals. Only if they are allowed to live and breathe will the Alps survive as an irreplaceable recreation area. ■

PETER MEYER *is a Swiss musicologist and specialist in German and English literature. He has been active in publishing since 1964, and is the publisher of an illustrated work entitled* Das Grosse ADAC-Alpenbuch *("The Big ADAC Book on the Alps"), and the bi-monthly magazine* Berge *("Mountains").*

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Photos © Max Gschwend, Brienz, Switzerland

The traditional Alpine house

Five examples of traditional domestic architecture in the Swiss Alps. (1) An apartment house for two families at Evolène in the canton of Valais, built in 1543. (2) House with steeply sloping roof at Einsiedeln, canton of Schwyz, dating from 1802. (3) Two-family house with adjoining living quarters at Ernen in the Valais. It dates from 1686. (4) Another two-family house with separate entrances at Lenk, canton of Berne. It was built in 1777. (5) Group of stone-roofed houses including a large house for two families, at Vrin, canton of Graubünden.

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Photo © National Library of Switzerland, Berne

by Brigitte Bachmann-Geiser

Horn of plenty

Barely 2 metres long, the alphorn of the early 19th century was held in an almost horizontal position by the instrumentalist, unlike its much longer modern counterpart which is played with its bell resting on the ground. Engraving (above) by the Swiss artist Franz Hegi (1774-1850), after a painting by Gabriel Lory, adorned the cover of a book entitled* Sammlung von Schweizer-Kühreihen und alten Volksliedern *("Collection of ranz des vaches and old Swiss folksongs"), Berne, 1818.

A Swiss legend describes how the alphorn was invented when a young dairy farmer was invited to choose a gift from among those offered by three weird strangers. A red ogre offered him strength and prosperity for his cattle; a green huntsman tempted him with guile, gold and the loveliest of maidens; but the youth chose to accept a gift from the third stranger, a pallid individual who offered the ability to yodel and play the alphorn.

Although the wooden trumpet has undoubtedly long been used by Alpine herdsmen, it is not recorded historically until the sixteenth century. The Zürich naturalist Conrad Gessner, seeing an alphorn for the first time in 1555 on Mount Pilatus near Lucerne, described it as being "made of two slightly curved, hollowed-out pieces of wood thickly covered with willow."

This simple design has changed little. Until about twenty years ago, however, the practice was to choose a fir tree growing on a slope and therefore curving up from the roots, strip off the bark, split the tree in two lengthwise and hollow it out with chisel and gouge. Alphorn makers now prefer to stick together pieces of high-quality wood and then carve them into the outer shape of the instrument, but the work of hollowing out the two halves has scarcely changed—it still takes more than seventy hours. The two halves are finally stuck together and covered with split cane. Formerly, protection from the weather was provided by whatever material lay to hand—cord, wire, birch or cherrywood bark, strips of nutwood or pieces of linen soaked in pitch.

Alphorns made in the nineteenth century have a recessed blow-hole, but today a mouthpiece specially cut out of boxwood enables players to transmit their lip vibrations to the air captured in the conical tube. With no finger holes, flaps or valves, this instrument cannot produce all the notes of the tone-scale. Consequently, the only notes that can be produced on the alphorn are natural sounds, including the well-

Photo Haller © Swiss National Tourist Office, Zürich

Herdsmen in central Switzerland today often take a smaller version of the alphorn called a* Büchel *with them to the summer pastures. They use this trumpet-like instrument, above, to play their traditional calls.

known "alphorn F" (see page 32), a note that sounds rather false. This limited range of notes over long intervals explains why all Swiss alphorn tunes have a family resemblance, whether they are traditional or recently composed.

Since the key of an alphorn is no longer determined by the length and thickness of a fir tree, and standardized instruments are now manufactured in a variety of pitches, the one-time calling and signalling instrument of the mountain herdsman can now be played by amateur musicians in duets, trios, quartets and, of late, in alphorn choirs. This instrument, formerly used only in folk music, was introduced into "serious" music in 1971 with Jean Daetwyler's *Concerto for Alpine Horn and Orchestra.* Thanks to a number of professional hornplayers and to compositions by Etienne Isoz, André Besançon and Jost Meier, the alphorn is no longer a rarity in concert halls, or even in churches as an accompaniment to the organ.

The extension in the use of this herdsman's instrument to contemporary and "serious" music has brought the alphorn

***Below, a postcard sent by Johannes Brahms to Clara Schumann on 12 September 1868. On it the German composer noted a Swiss alphorn melody with the message: "From the mountain heights, from the valley depths, I send you a thousand friendly thoughts." Brahms later incorporated this melody into the fourth movement of his* Symphony No. 1 in C Minor.**

Photo © German National Library, West Berlin

Since 1971, when the Swiss composer Jean Daetwyler wrote a* Concerto for Alpine Horn and Orchestra, *the alphorn has made frequent appearances in the concert hall. Below, Joseph Molna is the alphorn soloist in a performance of Daetwyler's work given at Nymphenburg Castle, Munich (Fed. Rep. of Germany) by the East Switzerland Chamber Orchestra, conducted by U.P. Schneider.

Photo © Brigitte Bachmann-Geiser

back into fashion in Switzerland, and the thirty or so craftsmen who still make the instrument set lengthy delivery dates!

This was not always the case. The organizers of the first Alpine festival, held near Interlaken in 1805, expected a big turnout for their horn players' competition, but their hopes were in vain. Only two candidates appeared, and they shared the prize of two black sheep. Travellers' accounts from the early nineteenth century reported that the Swiss national instrument was dying out. Thus the Berne painter Franz Niklaus König wrote in 1814 that "the alphorn is scarcely heard or seen anymore" and suggested to the authorities of his canton that they organize the manufacture of the instrument and instruction in its playing. The Sankt Gallen composer Ferdinand Fürchtegott Huber (1791-1863), who was interested in the music of the mountain people and had recorded the songs and yodels of the herdsmen in the Bernese Oberland, was sent to Grindelwald in the summer of 1826. He gathered young singers from the region into an inn and had them each sing in turn. The six most promising were enrolled in a two-month course, which was repeated the following summer.

The well-known form of alphorn with an upcurved bell, the trumpet-like, serpentine *Büchel* of central Switzerland and the straight metal tuba of the Graubünden highlands were still being played by herdsmen in the 1940s as traditional working instruments. As recently as 1972, an aged Valaisan from La Sage (Val d'Hérens) recounted how people waited every summer evening for the sound of the alphorn. A melodic air meant that up in the Alps all was well, while single, repeated notes were a signal for the men in the valley to go to the aid of the herdsman on the mountain.

On 12 September 1868, Johannes Brahms noted a horn melody on a postcard he sent to Clara Schumann. Was it a tune from the Rigi or the Stockhorn? We do not know. We do know, however, that the great composer immortalized this melody from Swiss folk music in the fourth movement of his first symphony, which he completed in 1876. ■

BRIGITTE BACHMANN-GEISER *is a specialist in Swiss folk music instruments, about which she has written a number of works including* Die Volksmusik-instrumente der Schweiz *(1981). With the support of the Swiss Federal authorities, the canton of Berne and the municipality of Burgdorf, she is currently setting up a museum and institute of folk music and instruments at Burgdorf.*

by Mario Müller

Song without words

The art of yodeling

TOURISTS visiting Alpine lands, especially Austria and Switzerland, tend to regard yodeling as a uniquely Alpine phenomenon.

However, although this special kind of singing is strongly developed in the Tirol and the Swiss Alps, it is also practised elsewhere. It can be heard in Poland, Lapland, Romania, the Caucasus, China, Democratic Kampuchea, Thailand, Java, Melanesia and Polynesia, and among the African Pygmies.

Yodeling is a form of singing without words in which the performer vocalizes syllables and changes frequently from low chest notes to high falsetto notes over a wide range. In the Alps, yodeling is performed solo or by up to five voices and exists in different forms such as the *Jauchzer* (cry of joy), and the *Lockrub* (birdcall), folksongs with a yodel refrain and—quite recently—even yodel masses.

There is much evidence to suggest that yodeling was widely practised in prehistoric times. Among the variety of theories put forward to explain its origin, some see it as a search for echo effects or as a way of expressing emotions, others as a reflection of the landscape in which its devotees live.

Whatever the true explanation may be, yodeling seems undeniably to be of very ancient origin; its archaic character is strikingly apparent in the so-called *Naturjodel* with its F natural lying between F and F sharp, which is still sung today in the Swiss valley of Muotathal (canton of Schwyz).

At one time, yodeling was a part of everyday life and tradition, developing as it was transmitted from one generation to the next. Today, in a more artificial form, it has become part of the urban cultural repertoire. Yodeling now has its authors, its composers and its public. ■

MARIO MÜLLER, *of Switzerland, teaches Italian and French language and literature at the cantonal school, Schaffhausen. From 1976 to 1984 he was Secretary-General of the Swiss National Commission for Unesco. He was a co-founder in 1979 of the* Société pour la Musique Populaire en Suisse, *of which he is president. He contributed to a collective work,* Volksmusik in der Schweiz *("Folk Music in Switzerland"), published in 1985.*

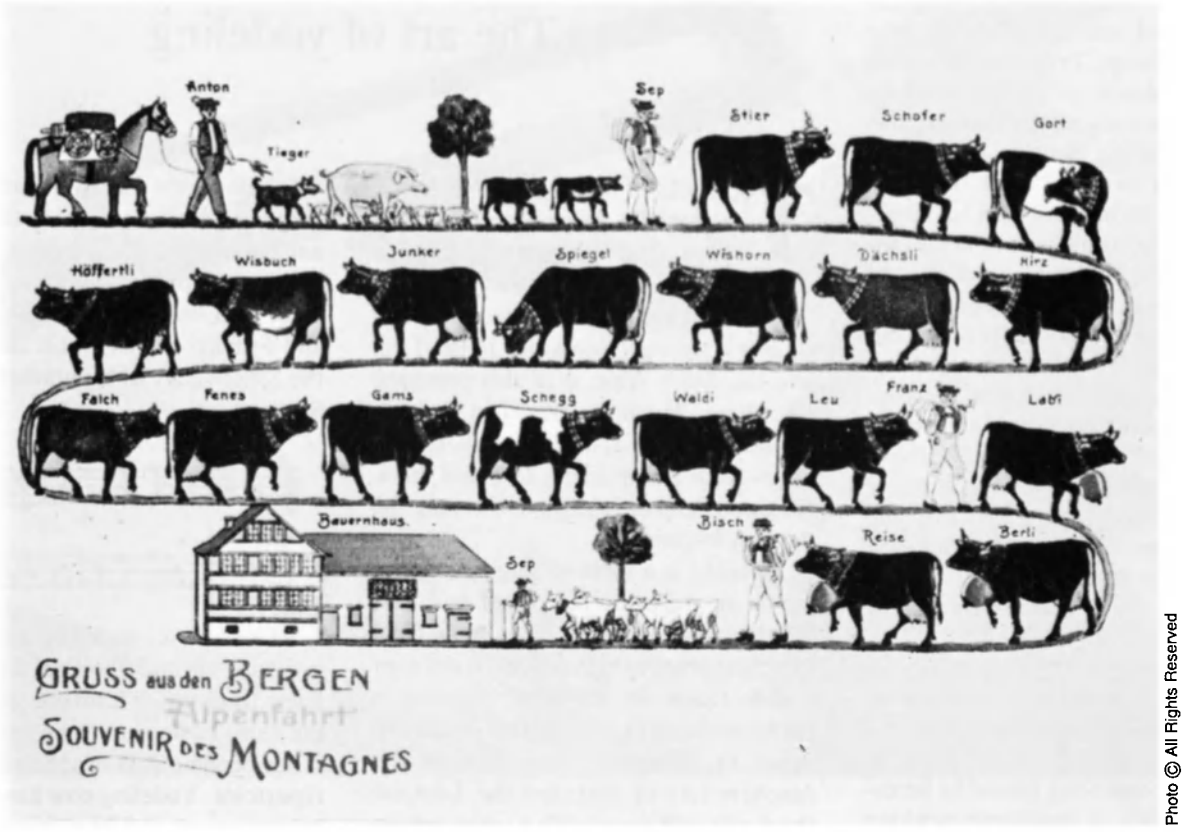
In many parts of Switzerland festivals are held each summer to celebrate the cultural heritage. Right, a group of yodelers from the Bernese Mittelland wearing traditional costume.

Photo © Swiss National Tourist Office, Zürich

The ranz des vaches

Distant echoes of an old Swiss melody

by Guy Métraux



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Above, a souvenir postcard from Appenzell, Switzerland, depicting the annual trek of herdsmen and animals to and from the high pastures.

IN all pastoral societies in which livestock are central to the economic and cultural life of the community, a relationship that is both practical and personal develops between the men and the animals in their charge. This relationship is expressed in calls, either vocal or instrumental, wordless tunes, onomatopoeic noises, songs, or even incantations used to control the herds.

On a more subjective level, the herdsmen can express a variety of feelings in this way. Poems, songs and calls in which the human voice or the horn are the chosen instruments of communication between man and beast are found in the Rundi pastoral societies of Central Africa, among the shepherds of the Balkan plains and the Lapps of the Far North, on the Argentine pampas, and among the cowboys of the American Far West.

In Switzerland, in the cattle-breeding communities of the Pre-Alps and the Alps—with the exception, however, of the outlying Graubünden (Grisons), the Valais and the Jura—the ranz des vaches is a working song which is part of the universal oral tradition of pastoral music. Published for the first time in 1545 in a German book, it has been transmitted in various forms, scholarly and otherwise, collected by travellers, musicians and, later, musicologists. Over the centuries it has become imbued with symbolism and cultural significance that extend far beyond its original purpose in pastoral society.

Initially, the ranz des vaches was probably a melody or tune played on the alphorn (see page 29), which was used to call the herds of cattle scattered through the mountain pastures. The words came later; the few versions that we have are all dated later than 1750.

Characteristic of the ranz des vaches are its varied rhythms and a highly specific tonal feature of traditional music, the F of the alphorn. This is a note midway between F natural and F sharp, to which the modern ear is no longer accustomed, and which has disappeared from most of the learned transcriptions that have come down to us. In fact, the modern ranz des vaches is no more than a distant echo of the music that once rang out in the Alps.

One example of the traditional ranz des vaches is that of Appenzell in north-east Switzerland. Transcribed around 1750, it seems very close to the early model whose words and music had a three-part structure.

- The call: The herdsman (or the alphorn) lets the herd know that it is milking time, or time to return to the cowshed, or to go up to the high pastures. The key word is *Lobe* in German or *Liauba* in French. This is a term of uncertain origin, possibly onomatopoeic, which designates a cow.
- The roll-call of the herd: This is an individual call to the cattle. Each cow is singled out by its name, which may be picturesque, descriptive or affectionate. The Appenzeller herd of 1750 consisted of twenty-seven head of cattle, with such

names as: "the Old Woman", "the Limper", "Hairy", "the Flibbertigibbet", "Fat Belly" and "the Dazzler".

• Narrative: The singer sprinkles this working song with comments on life in the high pastures and the difficulties of the herdsman's life. "Since taking a wife,/ I'm out of bread;/Since taking a wife,/I'm out of luck", recalls the anonymous composer of Appenzell. Obviously, each singer had his own personal frame of reference and there was no standard text as is the case today.

Since 1813, when it was transcribed by P.C. Bridel, the ranz des vaches of Gruyère has been the basic model which most Swiss people know and which features in the repertoire of popular and "serious" music in many countries.

In the early decades of the nineteenth century, in Switzerland, in neighbouring countries and even in England, musicians and poets began to draw inspiration from the ranz des vaches in composing Alpine-style neo-folk music in which the themes and images of Romanticism recur. The many composers who used the ranz des vaches as a source of rural colour include Beethoven (in the *Pastoral Symphony),* Berlioz (in the *Symphonie Fantastique),* Robert Schumann (in *Manfred)* and Wagner (in Act 3 of *Tristan and Isolde*). Many operas also contain allusions to the ranz des vaches, including Rossini's *William Tell* and the Swiss composer Gustave Doret's *Les Armaillis.* In 1828, at the Royal Opera House in Covent Garden, London, Sir Henry Rowley Bishop, the author of the well-known song *Home, Sweet Home,* produced a work entitled *Home! Sweet Home! or The Ranz des Vaches,* in which the old Alpine tune is cleverly blended with his work. Franz Liszt also composed many variations on the ranz des vaches based on versions which he had heard during his travels in Switzerland.

For the Swiss, the ranz des vaches has always had a very special meaning. It has long been a reminder of the past, a Rousseauist "memory marker" of a golden age in the heart of the Alps, as well as a poetic image of nature in which people lived their lives in freedom. Today, it is a mythical evocation of a certain vision of Switzerland and the pastoral folklore associated with it. ■

GUY METRAUX *is a Swiss historian and a former Unesco staff member who served as Secretary-General of the International Commission for the publication of a* History of the Scientific and Cultural Development of Mankind *and as editor of the international journal* Cultures. *He is the author of* Le ranz des vaches—Du chant des bergers à l'hymne patriotique *(1984, "The ranz des vaches—From the Herdsmen's Song to the Patriotic Hymn").*

Photo © Cantonal Fine Arts Museum, Lausanne

Above,* Lioba, *(1885), a painting by the Swiss artist Auguste Baud-Bovy (1848-1899). An Alpine herdsman calls his cattle, widely scattered over the mountain pastures.

Two scores based on Swiss ranz des vaches melodies. Right, a popular, traditional version by Ferdinand F. Huber, entitled* Der Ustig *("The Spring"). Below, one of many variations on this theme by Franz Liszt, who, like many other European musicians and poets in the 19th century, drew inspiration from Swiss folk music.

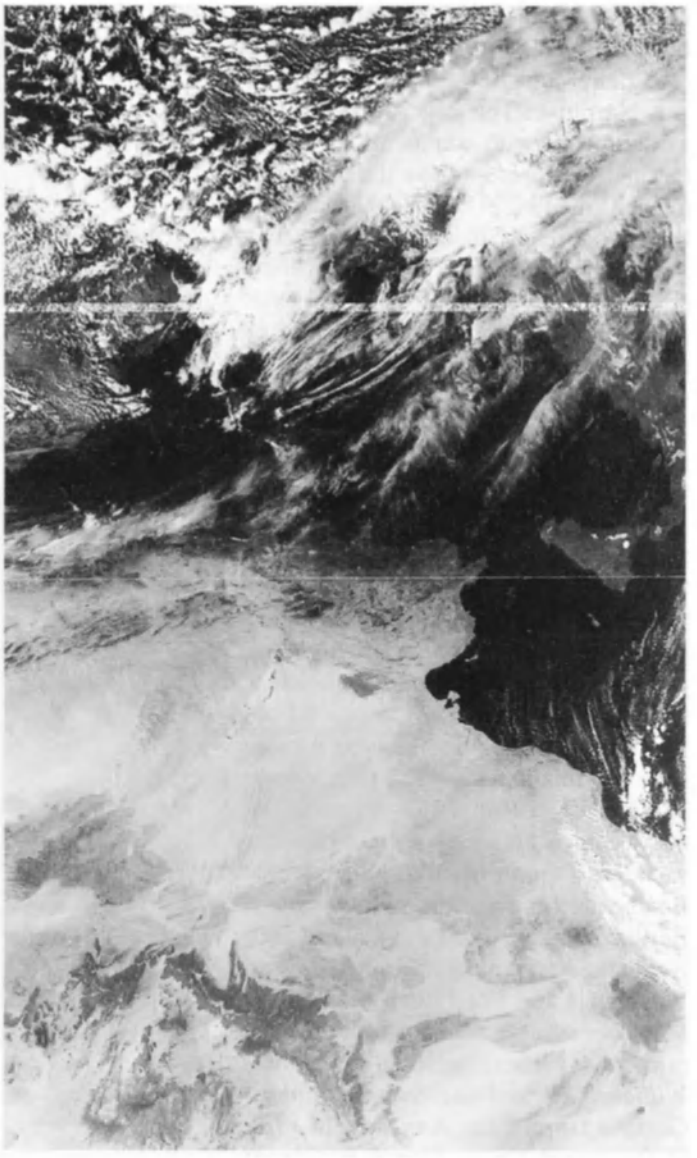
Photo © National Library of Switzerland, Berne

Photo © Central Library, Zürich

The ALPEX experiment

An international study programme on Alpine meteorology

by Roger Newson



THE unique character of the weather over and near the world's mountainous areas is well known, and the great diversity of weather events that may occur in this situation is nowhere better illustrated than by the meteorology of the Alpine region. There is an enormous variety of weather types in this region, and the rapidity of change from one type to another can be breathtaking.

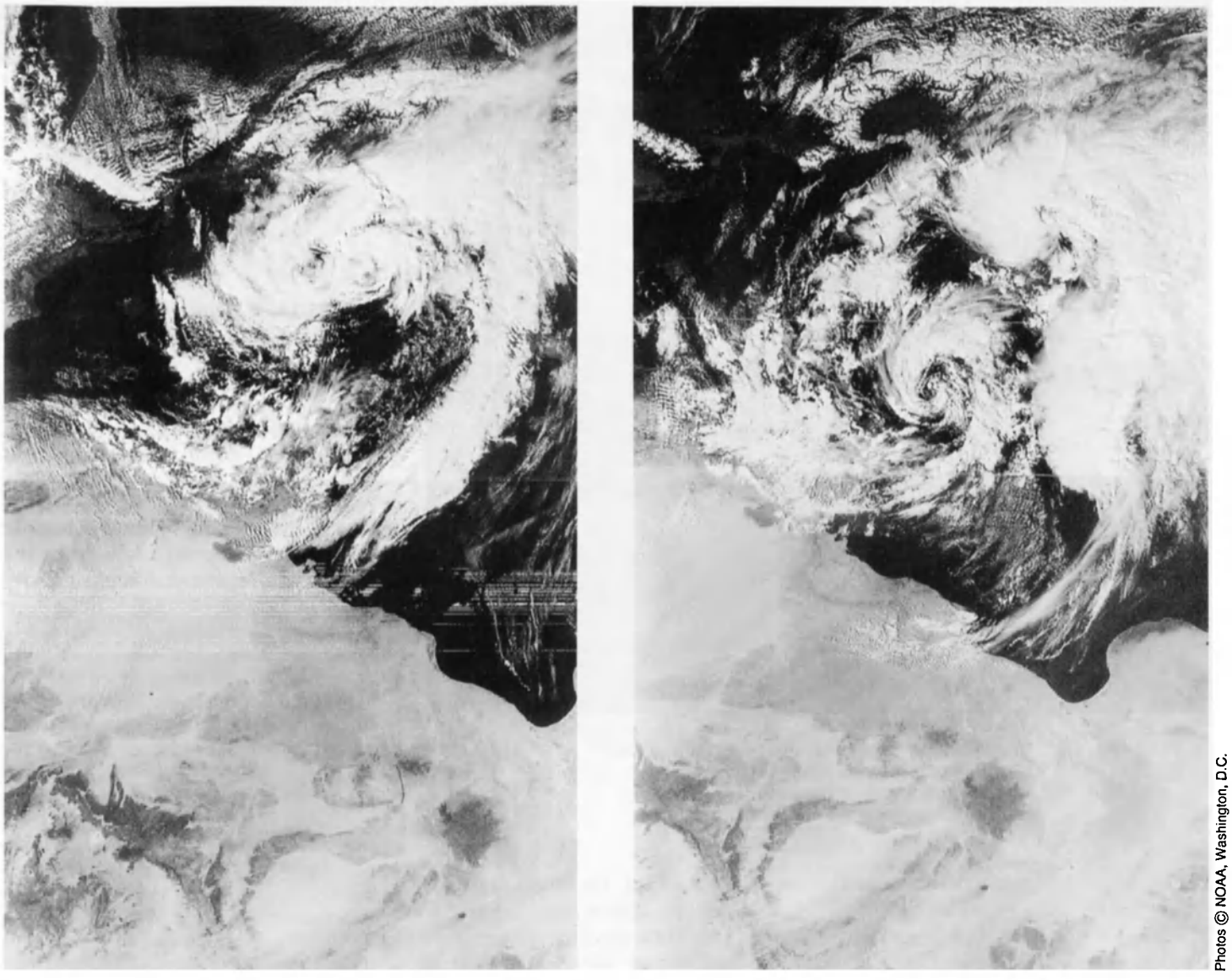
In countries near the Alps some of the most significant meteorological effects are associated with the generation of deep depressions in the Gulf of Genoa which are known as "Genoa cyclones". These depressions develop very rapidly and are often associated with strong winds, heavy rain, flooding and storm surges in the Mediterranean basin. The catastrophic floods in Florence in 1966 were linked with the development of one of these "Genoa cyclones", as are the periodic tidal surges which from time to time affect Venice. The characteristic local winds in the Alpine region, such as the Foehn and the Mistral, which occasionally blow with destructive force, are also well known phenomena.

In principle, the fact that extensive mountain ranges have major effects on the weather should cause no real surprise, since a mountain barrier will obviously deflect the atmospheric circulation both vertically and horizontally. The Alps straddle the path of the prevailing westerly winds and weather systems coming from the Atlantic, thus causing significant interruption to the natural air flow and leading to a variety of sometimes dramatic local effects. The sudden development of a Gulf of Genoa cyclone as an Atlantic weather system comes up against the Alps is vividly illustrated in the sequence of satellite pictures above.

The important role that mountains play in determining weather and climate over considerable areas of the globe was recognized from the outset of a major international meteorological research investigation, the Global Atmospheric Research Programme (GARP), whose overall objective was to study the dynamics of atmospheric phenomena in order to extend the range of useful weather forecasts.

The success of this fifteen-year programme, jointly organized by the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU) in response to resolutions adopted at the 16th and 17th sessions of the General Assembly of the United Nations, has led to dramatic progress in meteorology as a whole. In particular, GARP included a major field investigation, the 1982 Alpine Experiment (ALPEX), the aim of which was specifically to understand the way in which air flows over or around mountains, the development of cyclones such as those in the Gulf of Genoa, and local mountain winds.

One of the main characteristics of mountain weather is the small scale, meteorologically speaking, of the features involved and their sudden generation and disappearance. Accordingly, ALPEX was designed to gather sufficiently detailed information in space and time over the Alpine region. The mete-



Photos © NOAA, Washington, D.C.

A sequence of satellite pictures taken on 4, 5 and 6 March 1982 shows the development of a cyclone over the Gulf of Genoa. Left, the clouds of an Atlantic weather system approach the Alps; centre, a cyclone develops between Genoa and Corsica; right, the mature depression covers much of the Mediterranean.

orological services and scientific communities of twenty nations took part in the Programme, and several years of intensive efforts and detailed planning culminated in the implementation of a Special ALPEX Observing Period from 1 March to 30 April 1982.

For this, the existing network of observing stations was supplemented by thirty-four additional stations which provided many extra measurements of pressure and wind at all levels of the atmosphere. An array of sixty microbarographs, capable of tracing with great precision the slightest fluctuations in pressure, was set up along the St. Gotthard and Brenner sections of the Alps. Seventeen aircraft operating from Geneva undertook numerous sorties on predefined tracks, collecting many observations on wind speed and direction. In the Mediterranean itself, information was gathered from eleven research vessels and many buoys, field platforms and tide-gauges. All this was supplemented by images and atmospheric sounding data from meteorological satellites. This extensive range of observations has been assembled to form a unique quality-controlled internationally available data set. Never before have observations of comparable quality and density been produced over a mountain region.

Since 1982, the ALPEX data set has been fully exploited as both a foundation and an inspiration for research and, as a result, considerable advances have been made in knowledge of the effect of mountains on the atmospheric circulation. One of the main achievements has been a greatly increased understanding of how mountains should be treated in the numerical models of the atmosphere now used routinely for forecasting the movement of weather systems and the generation of new features such as depressions and anticyclones. It was found that at least a fraction of the error in forecasts could be attributed to an insufficient representation of the blocking effect of mountains on the air flow. Improvements have now been introduced into numerical models in this regard with consequent significant benefits for operational weather forecasting.

ALPEX data have also permitted a detailed analysis in three dimensions of the structure of lee cyclones such as the Genoa cyclones and identification of mechanisms contributing to their intensification. It has also proved possible, using particularly refined versions of numerical models, to reproduce the behaviour of these features more faithfully. Again, an improvement in the

Photo George Rodger © Magnum, Paris

The weather station at Gornergrat, near Zermatt in the Swiss Alps. Mountains play an important role in determining weather and climate over large areas of the earth.

skill of predicting the occurrence and intensity of lee cyclones, which can have such severe effects, has important implications for operational weather forecasting.

Using the ALPEX data set, it has also been possible to examine in detail the behaviour of the atmosphere flow as it approaches a mountain range, revealing a sharp division between the low level flow going predominantly around and the upper level flow moving over the mountain. The reproduction of this splitting pattern in weather prediction models is a key test of their performance in capturing the perturbing effect of mountains. The phenomenon of flow splitting is also a factor in the deformation of weather systems as they cross the Alps and much has also been learned on this subject as a result of ALPEX.

Finally, using particularly the data gathered in the aircraft missions, it has been possible to carry out studies of the structure of the strong local wind systems which occur near mountains, and views on the nature of the driving mechanisms for these winds are now converging.

In the light of the results obtained, it can already be said that ALPEX was a highly successful project. The co-operation of the participating countries and the authorities involved was outstanding, especially that of the many aviation bodies. Indeed, there is considerable follow-up action in some of the Alpine countries—Switzerland, Austria, the Federal Republic of Germany and Italy have formed an organization called "ALPEX Regional" which is continuing the co-operation established in ALPEX and undertaking further examination of particular mountain weather manifestations. The impact of the scientific results on atmospheric physics has already been significant and will grow in the next few years. An important side effect has been the stimulation of research and the generation of many new ideas. ■

ROGER NEWSON, *of the United Kingdom, is senior scientific officer of the World Climate Research Programme, which is a joint programme of the World Meteorological Organization and the International Council of Scientific Unions, based in Geneva, Switzerland.*

TODAY glaciers cover 3,200 km² of the Alps—roughly the same area as those of Scandinavia and some twenty times more than those of the Pyrenees, but barely one-tenth of the maximum glacier area during the Pleistocene Epoch. The erosive action of this enormous mass of ice as it advanced and retreated gradually shaped most of the lake basins in the Alps, although tectonic occurrences also contributed to the formation of many such basins including those of the Bodensee and the Traunsee.

But one thing is certain. The basins of some Alpine lakes were formed very long ago, possibly even in the Tertiary Period (more than 1.5 million years ago), whereas the present lake stage may be scarcely older than 18,000 years.

So one of the most interesting questions facing limnology, the scientific study of lakes, is how our modern lakes developed. So far our knowledge of their history is fragmentary. One piece of information was gleaned when construction work on the highway near the Mondsee in Upper Austria brought to light lake sediment from the last interglacial period (between the Riss Glacial Stage and the Würm Glacial Stage). This revealed not only that the water level of the Mondsee was then 60 metres higher than it is today but also that it formed part of a much bigger lake embracing both the Irrsee and the Attersee. It has also been established that the water level of Lake Waginger in Bavaria has fallen 15 to 20 metres since the Würm Glacial Stage.

On the other hand, archaeologists are convinced that the construction methods used in Alpine lakeside dwellings between 4,200 and 5,900 years ago were possible only if the water level was several metres lower. But this assertion, which would imply the absence of outflows and therefore a higher salt content in the lakes in question, has not been confirmed by limnology.

There were also—and no doubt still are—a number of lakes with a lifespan of no more than a few thousand years. They largely originated during the retreat of the great glaciers, as in the Salzach and Enns valleys, which were filled with boulders and debris within this short period. Masses of water could also be dammed up behind terminal moraines and lead to the flooding of valleys. This phenomenon, which is found more rarely in the Alps

Lakes and glaciers of the Alps

by Heinz Löffler

than in some other mountain regions, led to catastrophe in the Andes not long ago.

Some small lakes connected with the advance and retreat of glaciers have an even shorter lifespan. Since the last maximum glacier level around the middle of the nineteenth century, many lakes have emerged in this way and in some cases disappeared, including the small Eisrandsee near Hochkönig (Salzburg), which completely emptied through a newly formed ice tunnel in September 1934.

The Alpine lakes have been subject to human influences since ancient times. Control and drainage operations and wetland reclamation led to the drying out of some basins. Water pollution as a result of the discharge of chemical waste, stocking with fish and lakeside housing

Pasterze, Austria, the largest (8 km long and around 5 km wide) glacier of the Eastern Alps and one of the most beautiful of all Alpine glaciers, is fed by the snows of the Grossglockner. It has been for many years in a state of recession.

Photo © Lothar Beckel, Bad Ischl, Austria

Photo © Lothar Beckel, Bad Ischl, Austria

The Mondsee and the Attersee lakes in Upper Austria, both of which formed part of a bigger lake during an interglacial period in prehistoric times when relatively moderate climatic conditions melted Alpine snow and ice to create a water level 60 metres higher than it is today.

development were and are human activities whose effects have been known for years and are, albeit sporadically, controlled. In the meantime, however, transregional phenomena such as acid rain and water pollution by effluents (see the *Unesco Courier*, January 1985) are affecting extensive areas in the Alps, and causing new problems in lake protection.

However, while the disappearance or pollution of lakes in the distant and more recent past is to be deplored, it must be admitted that new stretches of water have been created in recent decades. Dammed lakes (Alpine reservoirs), artificial lakes and controlled natural lakes containing considerable quantities of water (over 1.5 thousand million m^3 in Austria alone) contribute primarily to energy production.

These developments create problems for landscape and nature protection. Lakeside areas, devoid of scenic attraction and mostly arid, at low water levels unfortunately resemble the astatic waters of arid zones. In many cases the damming of lakes has destroyed valuable wetlands or even led to the disappearance of endemic species—two Coleoptera belonging to the Staphylinide group in the case of the upper Stubach valley in Austria.

Today the threats once posed by glaciers, snow and Alpine waters are well understood and generally controlled as part of water supply management programmes. If catastrophes still occur in our time, they are chiefly connected with human intervention such as deforestation, acid rain, tourism, housing development in unsuitable areas, and, last but not least, the drainage of wetlands and the diversion of watercourses in such a way as to destroy the beauty of the landscape. ■

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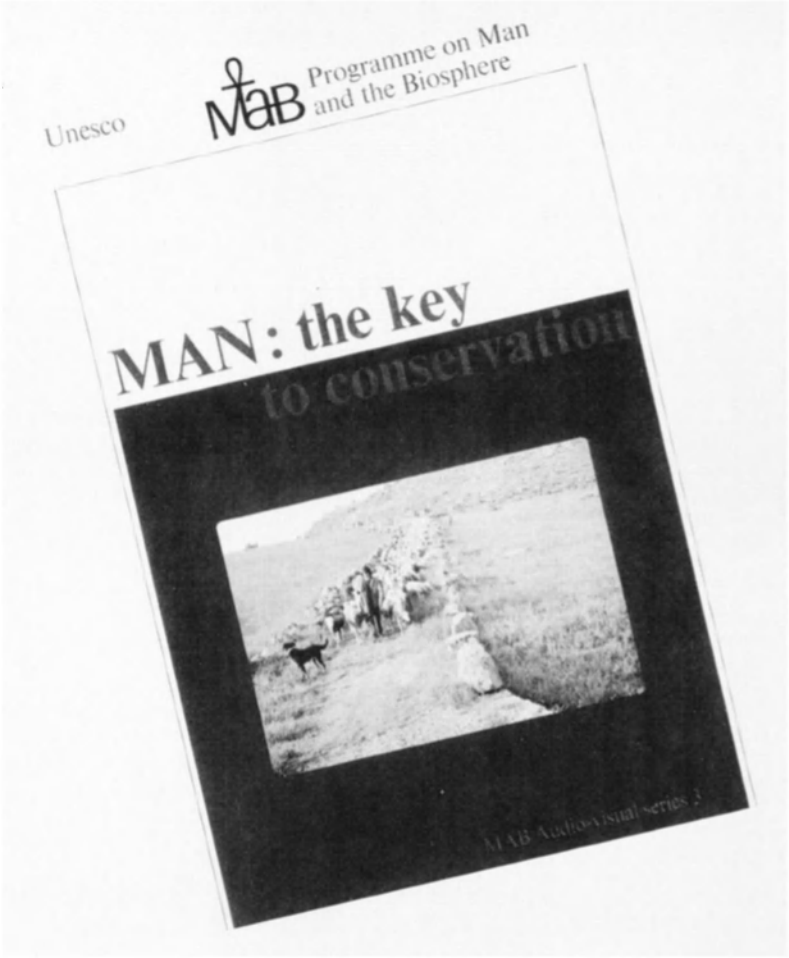

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